MONTHLY WEATHER REVIEW,

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(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In preparing this REVIEW the following data, received up to March 20th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 136 Signal Service stations and 15 Canadian stations, as telegraphed to this office; 182 monthly journals and 180 monthly means from the former, and 15 monthly means from the latter; reports from 5 Sunset stations; 240 monthly registers from Voluntary Observers; 56 monthly registers from United States Army Post Surgeons; Marine Records: International Simultaneous Observations; monthly reports from Voluntary Observers in, and the local Weather Services of, Iowa and Missouri, and of the Central Pacific Railway Co.; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

The mean pressure of the air over the United States and Canada, for the month of *February*, 1881, is shown by isobars on Chart No. II. The eastward movement of the area of high barometer (noted in the last month's REVIEW) has been still more marked during the present month, the region of maximum pressures having been transferred from the Mississippi valley to the Atlantic States, while the area of lowest barometer occupies the region covered by the maximum pressures of December, 1880. A glance at the chart at once reveals the effect of this redistribution of pressure upon the prevailing direction of the wind in the Gulf States, Tennessee, the Ohio valley and Lake region. On the Pacific coast, the highest pressures are over California, and the northerly winds along the coast would seem to indicate that the region of maximum barometer is over the ocean.

Departures from the Normal Values for the Month.—The region of greatest departure from the normal covers northeastern New York, Vermont and New Hampshire, being +0.15 at Albany and Mt. Washington and +0.16 at Burlington; along the New England coast it averages about +0.13, while the line of +0.10 runs from Cape May northwestward to Lake Superior. From this line of +0.10, in a southwesterly direction, it gradually decreases towards the line of no departure, which runs through Florida, Georgia, northern Alabama, Tennessee and Missouri. At Indianola the departure is —0.06 and at New Orleans —0.03. On the Pacific coast and in the Rocky Mountain region the departures are zero or quite small.

Barometric Ranges.—The range of pressure during the month has varied in the extremes from 0.36 inch at Key West to 1.72 inches at Burlington, Vt. Ranges of 1.00 and above were reported from stations in Washington Territory, Montana and Dakota, thence southward to Brownsville, Tex., and northeastward over the remaining sections of the country to the Atlantic coast, (except the East Gulf States,) with but the variance of a single station, viz.: Little Rock, Ark., 0.96. Throughout the territory included between the parallels of 30° and 47° and west of the 102nd meridian, the range varies from 0.32 at San Diego to 0.95 at Umatilla. Along both the Atlantic and Pacific coasts, the range increases with the latitude; along the southern boundary of the United States, the range increases quite rapidly from both California and Florida inward to the maximum in lower Texas. The smallest ranges occur at the southern stations—Key West and San Diego; the largest in the Upper Lake region and New England.

Areas of High Barometer.—Seven of these have been sufficiently marked to merit a brief description. The most remarkable was No. I, which occupied, in the last days of January, the Lake region, and continued in the same district until the 7th. It is, perhaps, due to this high area that the barometer for the month is generally above the mean east of the Mississippi River and the temperature below the mean for the same period. High areas Nos. IV and V, should, for the Pacific coast, be regarded as a single high pressure. As usual, all the minimum temperatures of the month are associated with the high barometers.

No. I was a continuation of No. VIII, briefly noticed in the January REVIEW. It was very remarkable for the persistence it exhibited in remaining over the Lake region, resisting successfully the development and advance of several depressions in the Southwest and extreme Northwest. At the morning report of the 1st the highest pressure on the chart extended from Manitoba to Lake Superior. During the day the barometer rose rapidly in the Lake region, Tennessee and the Ohio valley, accompanied by a "norther" in Texas and by northeasterly gales along the Atlantic coast from New Jersey to North Carolina. Cautionary Off-shore Signals displayed at Indianola and Galveston were justified by maximum velocities respectively, 44 N., and 25 NE. There was a great fall in temperature from the Ohio valley to the Rio Grande, averaging nearly 25°. The temperature east of the Rocky Mountains was generally below the mean, the greatest depression being in the Lake region. On the 2nd the highest barometer remained nearly central over Lake Huron; in the mean time a great fall in pressure was reported from the Northwest, accompanied by brisk to high southeast winds and by light snow which extended to Lake Michigan. At the morning observations minimum temperatures were recorded of —30° at Parry Sound, of —25° at Saugeen and —27° at Alpena. At the latter station the temperature was for the morning report 40° below the normal. The cold wave extended over the Atlantic States, the greatest fall in temperature taking place in the Carolinas and Georgia. On the 3rd the centre of the highest area moved slowly from Lake Huron to Lake Superior, due to a rise in pressure in the latter region and in the Northwest. The barometer in the Upper Lakes averaged more than one-half inch above the mean, the maximum reading reported being 30.71 at Marquette. On the 4th the highest pressure continued over Lakes Superior and Huron, accompanied by a great fall in the barometer, from the Lower Missouri Valley to Texas. The temperature remained low in the Lakes, where fair weather prevailed, with light winds mostly from the north. On the 5th the highest pressure was transferred to the Province of Ontario. During this day the following maximum barometers were observed: Rockliffe, 30.74, or 0.67 above the normal; Saugeen, 30.72, and Alpena 30.75, or 0.66 above the normal. During the day a great depression was developed, which extended from western Texas to Montana, and high southeast winds prevailed from the Northwest and Upper Lakes to the West Gulf coast. On the 6th the centre of the high area, with slowly increasing pressure, advanced into the St. Lawrence valley; the remarkably high isobar of 30.80 including this valley and the greater portion of the Middle States and New England. The pressure in these districts averaged more than 0.8 above the mean. The maximum reading at Burlington, Vt., was 30.97, or 0.88 above the normal. On the 7th the centre of the high area, with slightly diminishing pressure, moved into New England and along the Middle Atlantic coast. At the morning report the following observations were recorded at the several stations: Albany, 30.91; Burlington, 30.95. On the 8th and 9th, with rapidly diminishing pressure, this high area disappeared in advance of storm area No. III, then moving from the Gulf to the Lakes. During the regime of this high pressure, which was, as before noted, of remarkable persistence, the minimum temperatures of the month were generally reported from New England, Middle States, Lower Lake region and the eastern portion of the Upper Lakes and of Tennessee and the Ohio valley.

No. II—On the 9th the barometer rose slightly in Washington Territory and Oregon, which rise extended during the day eastward to the Missouri Valley. On the 10th a more rapid rise in pressure was reported from Manitoba, Dakota and Montana, and thence south to the Rio Grande. A "norther" was developed in Texas. Cautionary Off-shore Signals were justified by maximum velocities of 56 N. at Indianola and 26 N. at Galveston. On the 11th the pressure continued highest in Manitoba, but the greatest rise occurred in Texas; at Fort Garry the barometer, 30.58, was 0.46 above the normal. On the 12th the pressure from Montana and Dakota to the Rio Grande averaged 0.4 above the mean, and the prevailing temperature for the same region was from 20° to 25° below the mean. On the 13th the highest barometer continued in Manitoba, the reading at Fort Garry, 30.64, being 0.51 above the normal. On the 14th the region of highest pressure was transferred to the Middle States, accompanied by an extraordinary rise of the barometer in Nova Scotia and the Maritime Provinces, averaging more than 0.9 inch. At the morning observation the minimum temperatures of the month were reported from Madison, Davenport, Dubuque, La Crosse and Moorhead, being at the latter place —33°. On the 15th the centre of the high area had moved into Nova Scotia, and on the 16th disappeared beyond the coast in advance of low area No. V, then moving in an easterly track over the Lake region. During the continuance of this high area the lowest temperatures of the month were reported from nearly one half of the stations in the Southern States, and on the 11th from all the stations in southern California and

Arizona. In connection with this high area and low areas Nos. III and IV, Cautionary Signals were displayed on Lake Michigan, which will be more fully noticed in the description of those storms.

No. III.—On the 15th a great rise in pressure and corresponding fall in temperature occurred in the Southwest. Cautionary Off-shore Signals were displayed for a "norther" on the Texan coast, which were justified by maximum velocities of 36 N. at Indianola and 25 N. at Galveston. On the 16th the centre of high pressure moved into Illinois, where the barometer was in general more than 0.4 above the mean. On the 17th the high area was rapidly transferred to the Middle Atlantic coast in advance of low area No. VI, then developing in Texas. On the 18th it disappeared beyond Nova Scotia. In connection with this high pressure were generally noted the minimum temperatures of the month from Northern Texas, the Indian Territory, Arkansas, Missouri and Illinois.

No. IV.—On the 17th there was a marked rise of pressure on the Pacific Slope, which during the day extended in a southeasterly direction beyond the Rocky Mountains, the area of highest barometer being transferred to Texas and the Indian Territory. Cautionary Off-shore Signals ordered for a "norther" in Texas were justified by maximum velocities of 46 N. at Indianola and 26 N. at Galveston. On the 19th the high area moved over the Ohio valley and Lower Lakes, on the 20th advanced over the Middle States into New England, and on the 21st disappeared in advance of low area No. VII.

No. V.—The barometer remained above the mean on the Pacific coast on the 18th and 19th although the area of highest pressure had been transferred to Texas. On the 20th a slight rise took place in California, the barometer reading 30.4 at Red Bluff and at Sacramento. On the 21st the highest area moved into Oregon, Washington and Idado Tys. Maximum readings were reported at Roseburg of 30.48, or 0.41 above the normal, and at Boise City of 30.5, or 0.43 above the normal. On the 22nd from Washington Ty. to Dakota the barometer averaged more than 0.3 above the normal. On the 23rd the area of highest pressure was rapidly transferred to the Northwest and thence to the Upper Lake region. On the 24th, with diminishing pressure, this high barometer disappeared in advance of low area No. IX. During the continuance of Nos. IV and V on the Pacific coast no rain fell from the afternoon of the 18th until the 25th in California, Nevada, Utah and Arizona.

No. VI.—On the 24th there was a sharp rise in pressure in rear of low area No. IX. On the 25th the high barometer covered the Middle States. On the 26th this area disappeared beyond the New England coast.

No. VII.—On the 26th there was a very sharp rise of the barometer in Dakota and Manitoba in rear of low area No. X. The centre of the high area continued in Manitoba, during which time the centre of the low area moved very slowly to the eastward from northern Illinois to southern Michigan. On the 28th, with diminishing pressure, the highest area extended from Lake Superior to Iowa. Cautionary Northwest Signals displayed on Lake Michigan were justjfied by maximum velocities of 36 NW. at Milwaukee and 30 NW. at Grand Haven.

Areas of Low Barometer.—Ten such areas have had their tracks charted for the month of February, 1881. Of these, two—Nos. III and IV—appear to have been developed in the Gulf of Mexico. One only—No. II—with a defined track within the limits of the chart crossed the Rocky Mountains from the Pacific coast, and this disappeared in the Lower Missouri during the regime of high area No. I in the Lake region. Four—Nos. VII, VIII, IX and X—have their tracks first charted in the Northwest. Special attention is invited to the tracks of low areas Nos. III and IV, which are abnormal; a comparison made with the charts of the storm tracks for the month of February in previous years shows that not since the establishment of the Weather Service have any storms pursued for this month so northerly a course. These storms were both severe, No. IV being in some respects the most violent of the month. The great floods of February were all due to these two storms. The closest comparison is in February, 1874, when several low areas developing in the Southwest moved in a northeasterly track over the United States, but, as before stated, this office has no record of any storm tracks for February which pursued a course so nearly to the north. The maximum temperatures of the month are generally associated with the march of storm-centre No. X across the country.

No. I—which, at the morning report of the 1st, was central near Knoxville, Tenn., is a continuation of low-area No. IX described in January REVIEW. During the day it moved rapidly to the eastward and was accompanied by high northeasterly gales on the coast from New Jersey to North Carolina.

No. II.—On the 1st a great depression entered the North Pacific coast, the lowest barometer at Olympia, 29.41, being 0.52 below the normal, and, moving rapidly to the eastward during the day, the center of the low area crossed the Rocky Mountains. On the 2d there was a sharp fall in pressure in the Missouri valley, but the high barometer then prevailing over the Lakes did not yield and this depression, moving in a southeasterly track, disappeared as a distinct area of low barometer. During its passage over the Pacific slope very light rain fell in northern California,

but in Oregon and Washington Territory very heavy rains which continued for several days were reported; east of the Rocky Mountains, however, the precipitation was very slight.

No. III.—For several days before the 8th the barometer had been below the mean in the Southwest but with no well-defined center of depression. On this day the greatest fall was at New Orleans, where, at the midnight observation, the barometer was 29.61 or 0.52 below the normal. On the 9th the center of low-area moved in a northerly direction into Indiana, the barometer at Indianapolis 29.28, being 0.72 below the normal. On the 10th the centre of low area pursued its track to the north, but during the day there was a great fall in pressure over the Lower Lakes, Middle States and New England. Very heavy rain with consequent floods was reported from the Southern States and the Ohio valley. Cautionary Signals for this storm were ordered on the 8th from Mobile to Cedar Keys, on the 9th from Jacksonville to Wilmington and from Kittyhawk to Sandy Hook; these were generally justified by the following velocities: Mobile, 28 SW.; Pensacola, 28 SW.; Cedar Keys, 25 E.; Smithville, 28 SE.; Kittyhawk, 32 S.; Chincoteague, 36 SE.; Delaware Breakwater, 42 S.; Cape May, 39 SE. Cautionary Signals were ordered for Lake Michigan on the 9th and were justified by the following velocities: Grand Haven, 32 NW.; Milwaukee, 45 NE.

No. IV.—After the passage of low area No. III there was a sharp rise in pressure over the lower Mississippi valley, while along the Rio Grande the barometer continued very low. On the 10th the pressure in the Gulf began to yield in advance of low area No. IV, which was a secondary development in the Gulf of low area No. III; its centre at the midnight report of the 10th was located in western Louisiana. On the 11th, pursuing a track nearly parallel to No. III, its centre advanced into Illinois and Indiana, where the barometer was in general three-fourths of an inch below the mean. On the 12th, still continuing its northerly direction, the centre of low barometer was at the afternoon observation near Alpena, where the pressure of 29.22 was 0.9 below the normal; the depression then changed its path to the eastward, traversing on the 13th the St. Lawrence valley and New England. The heaviest rains accompanying this storm occurred in New England. High northeast gales, with heavy snow, were reported from the Northwest and Upper Lakes, and after the passage of the centre of depression in the Ohio valley and Lower Lakes a great fall occurred in temperature, accompanied by light snow and followed by clearing weather. Cautionary Signals for this storm were ordered on the 10th from New Orleans to Pensacola, on the 11th from Smithville, N. C., to Thatcher's Island, and on the 12th at Portland and Eastport. The signals on Lake Michigan were continued from the previous storm. These signals were generally justified by the following maximum velocities: New Orleans, 28 NW.; Mobile, 28 SW.; Pensacola, 31 SW.; Smithville, 34 SW.; Wilmington, 30 SW.; Macon, 33 SW.; Hatteras, 40 W.; Kittykawk, 42 S.; Cape Henry; 32 SW.; Norfolk, 33 SW.; Chincoteague, 40 SE.; Delaware Breakwater, 58 S.; Cape May, 50 S.; Barnegat, 36 S.; Sandy Hook, 28 W.; New York, 32 SE.; New London, 32 SE.; New Shoreham, 40 W.; Newport, 39 W.; Wood's Holl, 48 W.; Boston, 35 W.; Thatcher's Island, 40 NE.; Portland, 33 E.; Eastport, 40 SE. On the 12th the Cautionary Signals were changed to Cautionary Off-shore Signals from Smithville to Thatcher's Island, and were generally justified, both as to direction and as to velocity.

No. V.—At the morning report of the 15th the circulation of the winds and a slight fall in pressure indicated the formation of a low area in Missouri and Iowa, which development became by the afternoon better defined, the centre of depression being located near Davenport, and at midnight the low area had moved into Wisconsin near Madison. On the 16th there was a very sharp fall of pressure in the Lower Lakes, Middle States and New England, the centre of depression being in consequence transferred in sixteen hours from Madison to Eastport, Maine, and at the midnight observation the storm-centre was near Sidney. Snow accompanied the passage of this storm over the Lower Lakes and New England, while in the Middle States to the south of its track light rains were reported. Cautionary Off-shore Signals were orderod for anticipated high winds in rear of this storm on the 16th from Chincoteague to Sandy Hook and were justified by the following velocities: Chincoteague, 32 W.; Delaware Breakwater, 54 NW.; Cape May, 55 NW.; Atlantic City, 25 NW.; Barnegat, 32 NW; Sandy Hook, 34 W.

No. VI.—On the 15th the pressure was below the mean on the Pacific slope, with a slight fall in mercury during the day. On the 16th the fall extended in a southeastern direction, but the greatest fall was in western Texas, still the barometer was lowest in Utah and a sharp rise was reported from the North Pacific region. The movement of the centre of the depression was for these two days so indefinite that no effort was made to chart its track, but at the morning report of the 17th the lowest barometers were reported from the Rio Grande valley, accompanied by light rain, southeasterly winds and great rises in temperature. During the day there was only a slight movement to the eastward but a considerable increase was developed in the energy of the storm. On the 18th the center of depression advanced in an easterly track to eastern Tennessee; at the end of the day a trough of low barometer extended over Tennessee and the Ohio valley, the Lower Lake region and the Middle States. On the 19th, continuing its easterly track, the low-area passed beyond the limits of the chart; it was accompanied by very heavy rain, especially in the Middle and New England States. Cautionary Signals were displayed for this storm on the Atlantic coast

on the 18th from Chincoteague to Sandy Hook, and were justified by the following maximum velocities: Chincoteague, 43 SW.; Delaware Breakwater, 48 SW.; Cape May, 43 S.; Barnegat, 32 SW. Cautionary Off-shore Signals were ordered on the 19th for anticipated high winds in rear of this storm from Chincoteague to Sandy Hook, and were generally justified both as to direction and as to velocity.

No. VII.—At the morning report of the 19th, a storm-centre was located in eastern Montana, which had, probably, on the previous day moved in a southeasterly direction from the Saskatchewan valley. During this and the following day, developing but slight energy, it moved over the Northwest and Upper Lakes; thus far it had been accompained by occasional and very light snow and by gentle winds, but on the night of the 20th and 21st there was a very sharp fall of mercury on the Middle Atlantic coast, and the centre of depression was transferred in eight hours from the straits of Mackinac to the east Maryland coast. During the day, it is inferred from the fall of the barometer and the circulation of the winds on the North Atlantic coast that the centre of depression moved in a northeasterly track as charted. This storm exhibited but slight energy within the limits of the United States and no signals were displayed during its progress.

No. VIII.—On the 20th there was a sharp fall in pressure in Idaho and Montana, which, on the 21st, extended over the Northwest and Upper Lake region. This depression followed two days after low-area No. VIII and had its general characteristics; it was in these districts accompanied by slight precipitation and by winds ranging from gentle to brisk. It pursued, on the 22nd and 23rd, a course nearly due east over the province of Ontario, the St. Lawrence valley, Maine and Nova Scotia. After the passage of centre of low-area brisk to high northwest winds prevailed on the Middle Atlantic and New England coasts, and, later, it was followed by north to northeast gales on the North Carolina coast. Cautionary Signals were ordered on the 22nd from Chincoteague to Portland, Me., and on the 23rd from Norfolk to Smithville. These were generally justified by the following maximum velocities: Thatcher's Island, 46 NW.; Boston, 32 NW.; Wood's Holl, 40 NW.; Newport, 28 NW.; New Shoreham, 44 NW.; New London, 25 NW.; New York, 27 NW.; Sandy Hook, 36 N.; Barnegat, 33 NW.; Cape May, 44 NW.; Delaware Breakwater, 40 NW.; Chincoteague, 38 NW.; Cape Henry, 36 N.; Kittyhawk, 40 N.; Hatteras, 36 NE.; Macon, 25 N. Cautionary Signals were changed to Off-shore Signals on the 23rd from Chincoteague to Portland and were generally justified, both as to direction and to velocity.

No. IX.—On the 23rd there was a great fall of pressure in the Saskatchewan valley, which fall extended into Montana, Dakota and Minnesota. At the morning report of the 24th the centre of depression is found in eastern Dakota. From the morning to the afternoon observation the centre of the low area was rapidly transferred in a southeasterly track to a point near Keokuk, then on the night of the 24th and 25th the storm centre moved across the Ohio valley and Middle States to the Atlantic coast. This storm was accompanied by light snow, confined, as a rule, to the Lake region and the Middle States. No dangerous winds were reported.

No. X.—This low area, as well as the three preceding, was first evident in the British possessions north of the Upper Missouri valley. There was a sharp fall in pressure in Washington Ty. on the 24th, which leads to the inference that the centre of this depression may have crossed British Columbia on that day. On the 25th the depression pursued a southeasterly track. As charted on the 26th, until the afternoon report, the centre of the low area moved down the Missouri valley. At the afternoon observation a great depression extended from the Upper Lakes to the Rio Grande; the lowest barometer was reported from Leavenworth, 29.38, which was 0.62 below the normal. The track of the low area then turned to the east, and at midnight the centre was near Keokuk, with a deep trough-like depression extending from Lake Michigan to the West Gulf coast. Heavy rain fell to the east of this depression. On the 27th the low area moved very slowly to the east, but developed an immense increase of energy during the day; at the midnight observation the barometers were at Grand Haven, 29.25; at Detroit, 29.31; at Port Huron, 29.26, or below the normal respectively 0.76, 0.70, 0.71. Very heavy snow, with high northeast to northwest winds, prevailed in the Upper Lakes. During the night of the 27th and 28th, although the centre of the low area remained in southern Michigan, there was a very great fall of mercury on the Middle Atlantic coast. At the morning observation of the 28th the lowest barometer was at Port Huron, 29.36, or 0.62 below the normal; but a depression at the same hour extended from Buffalo to Washington, averaging 0.6 below the normal. From the morning to the afternoon the centre of the lowest area was transferred to the New Jersey coast, although at the p. m. report an independent depression was charted with its centre near Detroit. The low area then moved in a track to the north of east beyond the coast. Cautionary Signals were displayed for this storm on the 26th for Lake Michigan, and from Cape Henry to Sandy Hook; on the 27th from Smithville to Kittyhawk and from New York to New London; and on the 28th from Block Island to Portland. These signals were justified by the following maximum velocities: Milwaukee, 36 NW.; Grand Haven, 32 SE.; Smithville, 32 S.; Macon, 32 S.; Hatteras, 38 SE.; Kittyhawk, 39 S.; Chincoteague, 39 SE.; Delaware Breakwater, 36 S.; Cape May, 32 S.; Barnegat, 27 S.; New York, 25 NE.; New London, 36 S.; New Shoreham, 32 NW.; Wood's Holl, 52 SE.; Boston, 26 NE.; Thatcher's,

36 NE. These signals were changed to Cautionary Northwest Signals on Lake Michigan on the 27th. Cautionary Off-shore Signals were ordered on the 28th from Smithville to Sandy Hook, and were generally justified, both as to velocity and direction, as follows: Macon, 26 NW.; Hatteras, 32 NW.; Kittyhawk, 26 NW.; Cape Henry, 28 NW.; Chincoteague, 39 NW.; Delaware Breakwater, 44 N.; Cape May, 52 NW.; Atlantic City, 27 NW.; Barnegat, 37 NW.; Sandy Hook, 40 W.

INTERNATIONAL METEOROLOGY.

Two International charts accompany the present REVIEW. No. IV is for the month of *January*, 1881. No. V is for the month of *March*, 1877, and is published in accordance with the explanation given in the opening paragraph under International Meteorology in the January, 1881, REVIEW.

Chart No. IV, for the month of January, 1881, indicates as well as is at present (March 16, 1881) possible the general course taken by the most prominent storm-areas over the North Atlantic Ocean and adjacent land areas during that month. Nos. II, V and VIII are continuations of low areas Nos. I, V and VII, respectively, of chart No. I for January, 1881. Nos. I, III, IV, VI, VII and IX are prominent low areas appearing during the month on the European coast and which have been traced from the daily charts published by the various meteorological offices of Europe. The most notable meteorological feature of the month occurring over the North Atlantic, between the parallels of 35 and 55, was the remarkably low barometric readings experienced, especially from the 4th to the 9th over the region marked by area No. II, and from the 17th to the 31st over the regions marked by areas Nos. VII and VIII. During these periods the barometer fell below 29.0 or 736.6 on nine days, and on the 26th 28.37 or 720.6 was experienced in mid-ocean. As the area of low barometer No. VIII progressed slowly eastward during the 22nd, 23rd and 24th it so increased in extent that from the 25th to the end of the month it included not only the whole region under consideration but extended its influence over the greater part of Europe; thus on the 28th the pressure at Cape Breton was 29.16, in mid-ocean about 29.24, near the centre of depression about 28.9, at Mullaghmore 28.84, and at Gris-Nez 28.89. On the 29th the barometer at Mullaghmore fell to 28.65. The individual storms will be treated of at length on the presentation of Chart No. VI for this month; in the mean time the following characteristics of the weather over eastern North America, the portion of the North Atlantic under consideration, and western Europe may be grouped together with interest. Attending the low pressures over the ocean gales were reported on 28 days and severe or violent gales or hurricane winds on 12 days. The general direction of the storm winds was SE. or ENE. to the eastward of the 40th meridian and northwesterly to the westward, the latter to the north of the 40th parallel being accompanied by severe snow-squalls and freezing temperatures throughout the first and last decades of the month. Over the eastern half of the United States high pressures predominated, and exceptionally cold northerly winds generally prevailed from Vera Cruz, Mexico, northeastward along the entire Gulf and Atlantic coasts. In Europe severe storms, accompanied by unusually heavy falls of snow or rain, were experienced in all the countries bordering upon the Atlantic. The severe frost which prevailed from the 7th to the 26th and the heavy snow-storm and severe gales, which culminated on the 18th and 19th over the British Isles, are perhaps without precedent. The heavy snows in Paris and inundations in Spain may also be instanced as remarkably severe.

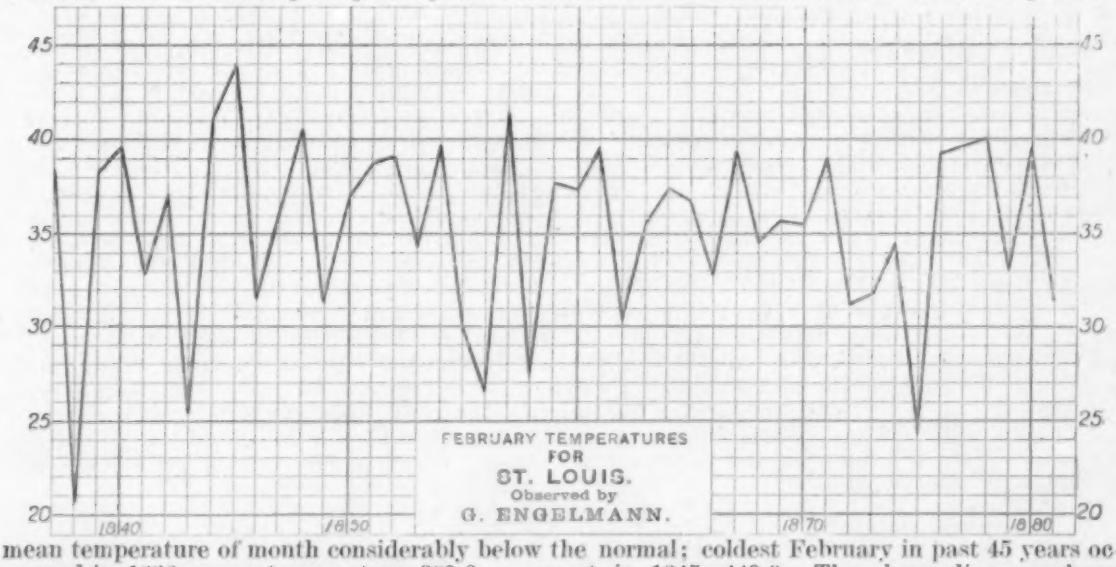
Chart No V—shows the mean pressure, temperature and wind force and the prevailing direction of the wind at 7.35 a. m. Washington, or 0.43 p. m. Greenwich, mean time, for the month of *March*, 1877, over the Northern, and at certain isolated stations in the Southern, hemisphere. During this month the Atlantic area of low pressure (as compared with January and February) is found more to the eastward, the lowest mean barometer (29.59 or 751.6) being that of Tromso, in northern Norway, while Thorshaven is 29.62 (752.3,) Stykkisholm, 29.66 (753.4,) and Godthaab, 29.74 (755.4.) The highest monthly mean is 30.24, or 768.1, at Barnaul, while the following means indicate other regions of comparatively high pressure: Angra, 30.17 (766.3,) Montgomery, Ala., 30.12 (764.8,) and Ft. Garry, Manitoba, 30.16 (766.0.) These give a barometric range in the monthly mean pressure of 0.65 inch, as compared with 1.28 in January, and 0.94 in Eebruary. The highest and lowest barometric readings, as reduced to sea level, were 30.70, or 779.8, at Barnaul on the 10th, and 28.76, or 730.5, at Thorshaven on the 12th, giving a total barometric range of 1.94 inches. The region of greatest continued cold is in Hudson's Bay territory, York Factory having a monthly mean of —22° F.; the lowest single reading observed during the month, —34° F., occurred at this station on the 4th, and again on the 11th. The prevailing direction of the wind was *north* or *westerly* over the North American continent, except *southerly* along the eastern slope of the Rocky Mountains, and *westerly* over Europe, trending to *southerly* over northern Asia, while *easterly* winds prevailed at Godthaab and Stykkisholm. In comparing the present with the preceding month, the most marked changes are found to be an increase in pressure from the Canadian Maritime Provinces (Sydney 0.19 inch and Heart's Content 0.36) to Godthaab (0.18), Stykkisholm (0.20) and northern Europe Tromso 0.15 inch), and a decrease elsewhere, amounting to 0.20 inch in Siberia, southwestern Europe and interior of the North American continent. The temperature changes show a decided fall over the last region,

which, at York Factory, amounts to 17°.4 F. and an almost general though only slight fall over western Europe; elsewhere a general increase is found, which, over eastern Russia and at all the Siberian stations, exceeds 20° F.

TEMPERATURE OF THE AIR.

Temperature of the Air.—The mean temperature of the air for February, 1881, is shown by the isothermal lines (in red) on Chart No. II. The table of mean and comparative temperatures in the right-hand corner of the chart shows in the first column the average for the month throughout the various districts as reduced in the main from observations taken at Signal Service stations, and covering periods ranging from three to eighteen years. In the two remaining columns are shown the present monthly means and departures from such means during February, 1881. Throughout the whole country east of the 107th meridian, including the northern Rocky Mountain slope but excluding New England and the Florida peninsula, the temperature has been below the normal. In the two latter districts and in the Northern Plateau region it has experienced no change, while to the westward in the remaining districts the temperature has risen above the normal. The following large abnormal deviations may be noted: Ft. Bennett, —14°.7; Omaha, —9°.7; Dodge City, —9°.0; Leavenworth, —7°.9; Yankton, —7°.2; North Platte, —6°.8; Ft. Gibson, —6°.6; Ft. Sill, —6°.2; La Crosse, —4°.5.

Deviations from Mean Temperatures.—Under this heading, departures exhibited by the reports from regular Signal Service stations are shown in the table of comparative temperatures on the right-hand side of chart No. II. The following items of importance, in connection with this topic, are reported from voluntary observers: *Illinois:* Belvidere, mean temperature 5°.7 below mean of February for past 14 years. Riley, mean temperature 5°.3 below mean of past 20 years; coldest February was in 1875; winter of 1880–81, 7°.2 colder than the mean of the winter seasons for the past 20 years; coldest winters, 1873 and 1875. *Iowa:* Clinton, mean temperature of month considerably below the normal. Logan, coldest in past 20 years. *Kansas:* Holton, coldest and roughest February ever experienced in the State. Lawrence, mean temperature 7°.21 below the mean of February for past 14 years; coldest February in 1875. *Maine:* Gardiner, mean temperature 0°.15 below that of February for past 45 years. *Maryland:* Sandy Springs, coldest in past 15 years. *Massachusetts:* Westborough, month unusually cold. Williamstown, month very cold. *Michigan:* Thornville, mean temperature 5° below that of February for past 10 years. Northport, month unusually cold, weather worst ever experienced. *Nebraska:* Howard, mean temperature 8° below that of February for past 5 years. *Missouri:* The Missouri Weather Service reports the



mean temperature of month considerably below the normal; coldest February in past 45 years occurred in 1838, mean temperature 20°.8; warmest, in 1845, 44°.0. The above diagram shows the curve of mean temperatures for February, as furnished by Prof. F. E. Nipher of the "Missouri Weather Service." As compared with the observations taken at the Signal Service stations in St. Louis during the past ten years, these curves appear to be reliable. *New Hampshire:* Grafton, month unusually cold and remarkable for rapid and extreme changes of temperature. Contoocookville, mean temperature about normal as compared with record of past 10 years. *New York:* North Volney, mean temperature, 2°.2 below that of past 12 years; coldest February in 1875, mean temperature 17°8; warmest in 1880, mean 28°.7. Palermo, coldest February in past 28 years, except 1868, 1875, and 1879; 1880–81, coldest winter in past 28 years, mean, 11°.7; warmest in 1877–78, mean, 27°.0. *North Carolina:* Portsmouth, coldest in past 20 years. *Pennsylvania:* Dyberry, coldest in past 17 years.

The following are the maximum and minimum temperatures reported in each State and Territory:

Maximum Temperatures.—Alabama: 72° at Montgomery. *Arizona:* 90° at *Texas Hill and 89° at Yuma. *Arkansas:* 75° at *Mount Ida and 72° at Little Rock. *California:* 96° at *Mammoth Tank and 86° at Los Angeles. *Colorado:* 86° at *Pagosa Springs and 61° at Denver. *Connecticut:* 54° at New London. *Dakota:* 65° at Rapid City and 58° at Deadwood. *Delaware:* 64° at *Dover and 56° at Delaware Breakwater. *District of Columbia:* 64° at Washington. *Florida:* 84° at Key West and 82° at *Houston. *Georgia:* 75° at *Thomasville and 74° at Augusta. *Iowa:* 57° at Keokuk. *Idaho:* 61° at Lapwai. *Illinois:* 62° at *Anna and 60° at Springfield and Cairo. *Indiana:* 64° at *Laconia and 59° at Indianapolis. *Indian Territory:* 72° at Fort Sill. *Kansas:* 65° at Dodge City, *Wellington and *Yates Center. *Kentucky:* 67° at Louisville. *Louisiana:* 78° at New Orleans. *Maine:* 50° at Portland and *Surry. *Maryland:* 64° at Baltimore. *Massachusetts:* 60° at *Westborough and 55° at Boston. *Michigan:* 54° at Detroit and *Marshall. *Minnesota:* 39° at *New Ulm and 34° at Duluth. *Mississippi:* 74° at *Fayette and 72° at Vicksburg. *Missouri:* 68° at *Pierce City and *New Springfield and 65° at St. Louis. *Montana:* 65° at Fort Custer and Rock Creek. *Nebraska:* 57° at *Camp Sheridan and 55° at North Platte. *Nevada:* 67° at Winnemucca. *New Hampshire:* 52° at *Auburn and 36° on summit of Mount Washington. *New Jersey:* 60° at *Atco, *South Orange and *Trenton, and 51° at Cape May and Atlantic City. *New Mexico:* 81° at La Mesilla. *New York:* 57° at New York City and Rochester. *North Carolina:* 72° at *Weldon and 71° at Wilmington. *Ohio:* 67° at Cincinnati. *Oregon:* 83° at *Eola and 63° at Portland. *Pennsylvania:* 63° at Pittsburg. *Rhode Island:* 50° at Newport. *South Carolina:* 73° at *Aiken and 71° at Charleston. *Tennessee:* 69° at Memphis, Knoxville and Chattanooga. *Texas:* 87° at Rio Grande. *Utah:* 63° at Salt Lake City. *Vermont:* 50° at *Charlotte and 49° at Burlington. *Virginia:* 71° at Cape Henry and 70° at *Johnsontown. *Washington Territory:* 64° at Dayton. *West Virginia:* 63° at Morgantown. *Wisconsin:* 46° at *Edgerton and 44° at Madison. *Wyoming Territory:* 59° at Cheyenne.

Those marked with a star (*) are reported by U. S. Army Post Surgeons or Voluntary Observers.

Minimum Temperatures.—Alabama: 23° at *Auburn and 30° at Mobile and Montgomery. *Arizona:* 10° at Prescott. *Arkansas:* 4° at *Fayetteville and 22° at Little Rock. *California:* 12° at *Cisco and 22° at Campo. *Colorado:* —30° at *Pagosa Springs and —25° on summit of Pikes' Peak. *Connecticut:* —7° at *Southington and —4° at New Haven. *Dakota:* —34° at Ft. Bennet. *Delaware:* 0° at *Dover and 7° at Delaware Breakwater. *District of Columbia:* 2° at Washington. *Florida:* 30° at *Houston and 31° at Pensacola. *Georgia:* 21° at Atlanta. *Iowa:* —24° at *Vail and —9° at Dubuque. *Idaho:* 6° at Lapwai. *Illinois:* —16° at *Elmira and *Belvidere and 4° at Champaign. *Indiana:* —14° at *Wabash and 1° at Indianapolis. *Indian Territory:* —8° at Ft. Supply. *Kansas:* —24° at *Clay Center and —10° at Dodge City. *Kentucky:* 6° at Louisville. *Louisiana:* 22° at Shreveport. *Maine:* —18° at *Orono and —6° at Portland. *Maryland:* —10° at *Deer Park and 4° at Baltimore. *Massachusetts:* —13° at *Williamstown and —5° at Boston. *Michigan:* —27° at Alpena. *Minnesota:* —33° at Moorhead. *Mississippi:* 28° at *Fayette and Vicksburg. *Missouri:* —16° at *Corning and 5° at St. Louis. *Montana:* —29° at Ft. Custer. *Nebraska:* —29° at *Camp Sheridan and —23° at North Platte. *Nevada:* 0° at *Toano and 13° at Pioche. *New Hampshire:* —36° on summit of Mt. Washington and —12° at *Grafton. *New Jersey:* —6° at *Vineland, *Atco and *Freehold and —4° at Atlantic City and Barnegat. *New Mexico:* —21° at *Ft. Union and —2° at Santa Fe. *New York:* —34° at *Schroon Lake and —7° at Buffalo and Albany. *North Carolina:* 7° at *Highlands and 11° at Kittyhawk. *Ohio:* —12° at *Westerville and —3° at Cleveland. *Oregon:* 25° at Umatilla. *Pennsylvania:* —19° at *Catawissa and —4° at Pittsburg. *Rhode Island:* —2° at Newport. *South Carolina:* 21° at *Aiken and 26° at Charleston. *Tennessee:* 18° at Knoxville, *Ashwood and *Clarksville. *Texas:* 9° at Stockton. *Utah:* —3° at *Terrace and 16° at Salt Lake City. *Vermont:* —22° at Woodstock and —18° at Burlington. *Virginia:* —1° at *Wytheville and 5° at Chincoteague. *Washington Territory:* —7° at Spokane. *West Virginia:* —2° at Morgantown. *Wisconsin:* —24° at *Neilsville and —16° at La Crosse. *Wyoming Territory:* —31° at *Washakee and —12° at Cheyenne.

Those marked with a star (*) are reported by U. S. Army Post Surgeons or Voluntary Observers.

Ranges of Temperature at Signal Service Stations.—Monthly ranges in general varied from 50° to 75° over the county east of the Rocky Mountains. Ranges less than 50° occurred in the following regions: eastern Maine, South Atlantic States, Tennessee, in the Gulf States westward to the Mississippi, in southern Wisconsin and northern Illinois, in southwestern New Mexico and southeastern Arizona, in northern Utah and Nevada and throughout the Pacific coast regions. The smallest ranges were: San Francisco, 24°; Key West, 25°; Sacramento, 27°; Punta Rassa, 36°; Olympia, 34°; Galveston, 36°; Portland, Or., Umatilla and Visalia, Cal., 37°; Red Bluff, 38°; Cedar Keys, 39°; Pensacola, 40°. The largest were: Rapid City, Dak., 95°; Ft. Custer, 94°; Helena and Rock Creek, Mont., 85°; Denver and Ft. Benton, 81°; North Platte and Deadwood, 78°; Ft. Shaw and Ft. Bennett, 77°; Yankton and Dodge City, 75°. The *daily ranges* varied in the different districts as follows: New England, from 21° at Eastport to 37° at Burlington; Middle States, 19° at Cape May to 37° at Fort Myer; South Atlantic States, 24°

at Fort Macon to 33° at Kittyhawk; Eastern Gulf States, 14° at Key West to 27° at Montgomery; Western Gulf States, 19° at Galveston to 33° at Little Rock; Ohio valley and Tennessee, 26° at Indianapolis to 37° at Morgantown and Pittsburg; Lower Lake region, 32° at Oswego to 39° at Toledo; Upper Lake region, 26° at Milwaukee and Chicago to 36° at Alpena and Port Huron; Upper Mississippi valley, 25° at Champaign and 28° at St. Paul to 38° at Keokuk; Missouri valley, 27° at Omaha to 40° at Ft. Buford; Red River of the North Valley, 35° at Moorehead to 37° at St. Vincent; Texas, 31° at Laredo to 55° at Stockton and 62° at El Paso; Eastern Rocky Mountain Slope, 34° at Ft. Gibson to 42° at Deadwood; Rocky Mountain, 25° on summit of Pike's Peak to 30° at Ft. Missoula and 41° at Cheyenne; Southern Plateau, 38° at Yuma to 49° at Prescott; Middle Plateau, 25° at Salt Lake City to 39° at Winnemucca; Southern Pacific coast region, 15° at San Francisco and 19° at Sacramento to 49° at Campo; Middle Pacific coast region, 15° at San Francisco to 33° at Red Bluff; North Pacific coast region, 23° at Lewiston and Olympia to 26° at Roseburg.

Frost—was reported on nearly every day throughout the month from stations north of the 36th parallel and east of the 114th meridian. Beyond these boundaries to the south and west it occurred in the various states on the following dates: North Carolina, 2nd to 8th, 11th, 13th to 18th, 20th to 24th; South Carolina, 12th to 15th; Georgia, 3rd to 5th, 13th to 15th, 22nd, 23rd; Florida, north of the 28th parallel, 3rd, 4th, 5th, 13th, 14th, 15th; Alabama, 3rd, 14th, 15th, 16th, 22nd; Mississippi, 3rd, 12th to 15th, 20th, 21st, 22nd, 28th; Louisiana, 2nd, 13th, 14th, 15th, 21st, 22nd; Arkansas, 2nd, 3rd, 13th. 14th, 15th, 20th, 21st; Texas, 1st to 3rd, 5th to 8th, 10th to 16th, 18th to 23rd; southern New Mexico, 1st, 4th, 6th, 11th, 12th, 13th, 15th, 16th, 18th to 23rd; southern Arizona, 1st to 3rd, 5th, 6th, 7th, 10th, 12th to 28th; California, (southern portion,) 6th, 7th, 10th to 15th, 19th, 20th, 21st, 24th, 25th, (northern portion,) 9th, 10th, 11th, 18th; Oregon, 6th, 7th, 8th, 12th, 13th, 14th, 16th, 17th, 18th; Washington Territory, along coast, 14th, 17th, 18th.

Ice—in the northern sections of the country is more properly exhibited elsewhere in the REVIEW under the head of "*Ice in Rivers and Harbors.*" Along the southern boundary of the country ice was reported from the following stations: Campo, Cal., 10th, 11th; Eagle Pass, Tex., 12th, 13th; Melissa, Tex., 11th, 12th; Indianola, 13th; Fayette, Miss., 13th, 14th, 15th; Mobile, 14th; Montgomery, 13th.

PRECIPITATION.

The general distribution of rain fall (including melted snow) for February, 1881, is shown on Chart No. III, from the reports of over 500 stations. From the table in the left-hand corner of the chart is obtained a monthly average for each of the various districts, determined from the records (covering a period of several years) of Signal Service stations, and also a comparison of the present month with such averages. The regions of greatest rain-fall are to be found along the Pacific coast north of parallel 40°, in northern Texas, northern Illinois, in the Western Gulf States and western North Carolina. The region of no precipitation, covering a territory of about 200 miles square, embraces a portion of southeastern California and southwestern Arizona. As compared with the mean of past years the rain-fall for the month is in general considerably above the average. The most marked departures occurred in the Middle and Northern Pacific Coast regions, Lower Missouri valley, Upper Lake region, Middle Atlantic States and in the central portion of the Western Gulf States. Departures of excess at particular stations were most marked in these districts. In southern Florida, southern Dakota and along the California coast south of parallel 40°, individual deficiencies were quite prominent. The rain-fall of the Rocky Mountain and Plateau districts, nearly always comparatively low, was quite evenly distributed, except in a narrow region extending northward from Salt Lake City.

In connection herewith the following notes from voluntary observers may be of interest. Riley, Ill., monthly rain-fall 4.05 inches above the average of February for the past 18 years and 1.77 inches greater than the largest amount ever recorded in February during the past 20 years. Lawrence, Kan., monthly rain-fall 2.37 inches above the mean of the past 14 years and much the largest of any February in that period. Gardiner, Me., monthly rain-fall 2.55 inches above the mean of the past 45 years; smallest in that period, 1.11 inches in 1844, largest 9.47 inches in 1853. The Missouri State Weather Service, Prof. F. E. Nipher, reports that the rain-fall has been quite uniform over the State, being on the average about four inches. This amount has been exceeded at the St. Louis station five times since 1839. North Volney, N. Y., monthly rain-fall 0.69 inches above the mean of the past eight years.

Special Heavy Rains.—1st, Galveston, 3.62 inches. 1st and 2nd, Albany, Or., 4.96; Portland, Or., 4.11; Neah Bay, Wash. Ty., 4.93; Ft. Stevens, Or., 3.30; Olympia, 3.74. 2nd and 3rd, Mt. St. Helena, Cal., 4.37; Ft. Gaston, 6.41. 3rd and 4th, Yosemite valley, Cal., 3.31. 4th, Eagle Rock, Mont., 1.98. 5th, Melissa, Tex., 5.00. 5th and 6th, Pilot Point, Tex., 2.51; Clarksville, Tex., 2.50; Logan, Ga., 4.09; Fayette, Miss., 3.00; Ft. Leavenworth, Kan., 3.10. 6th, Ft. Barrancas, Fla., 6.93. 6th and 7th, Mt. Ida, Ark., 3.20; Independence, Kan., 3.90. 7th, Mobile,

3.72. 7th and 8th, Ellsworth, N. C., 8.50; Montgomery, 3.11; Franklin, N. C., 6.00; Highlands, N. C., 6.30. 8th and 9th, Forsyth, Ga., 3.80; St. Meinrad, Ind., 2.80; Atlanta, Ga., 4.81; McPherson Barracks, Ga., 4.03. 9th and 10th, New Corydon, Ind., 4.04; Wellsboro, Pa., 4.12. 10th, Williamstown, Mass., 2.80. 10th and 11th, Murphy, N. C., 4.00; Melissa, Tex., 3.00. 11th, Ellsworth, N. C., 2.00; Atlanta, 2.92; Auburn, Ala., 3.06; Franklin, N. C., 2.50; Highlands, N. C., 2.90; McPherson Barracks, Ga., 2.40. 12th, Auburn, N. H., 2.25; Paterson, N., J., 3.20 in 6 hours. 17th and 18th, Pilot Point, Tex., 2.80; Mt. Ida, Ark., 3.50; Melissa, Tex., 10.00. 18th, Nashville, 2.57; Little Rock, 2.83. 18th and 19th, Quitman, Ga., 3.00; New London, 2.65; Newport, 2.70. 20th and 21st, Clarksville, Tex., 2.75. 21st and 22nd, Neah Bay, Wash. Ty., 4.69. 23rd and 24th, Neah Bay, Wash. Ty., 3.64. 26th and 27th, Mobile, 2.62. 27th and 28th, Mammoth Cave, Ky., 4.70; Albany, Or., 3.73; Portland, Or., 3.34. 28th, Auburn, N. H., 2.50; Wellsboro, Pa., 4.45.

Largest Monthly Rain-falls.—Neah Bay, Wash. Ty., 21.01 inches; Melissa, Tex., 18.11; Olympia, Wash. Ty., 16.28; Ft. Stevens, Or., 15.00; Ellsworth, N. C., 14.75; Albany, Or., 13.08; Portland, Or., 13.36; Ft. Gaston, Cal., 13.46; Eort Canby, Wash. Ty., 13.38; Highlands, N. C., 12.95; Alta, Cal., 11.80; Franklin, N. C., 10.90; Atlanta, Ga., 10.41; Ft. Barrancas, Fla., 10.16; Wellsboro, Pa., 9.97; Cisco, Cal., 9.61; Colfax, Cal., 9.30; Pensacola, Fla., 8.99; Fayette, Miss., 8.50; New Ulm, Tex., 8.33; Galveston, 8.29; Newport, 8.28; Auburn, Cal., 8.20; Roseburg, 8.19; New Corydon, Ind., 8.03; Mobile, 8.00.

Smallest Monthly Rain-falls.—Wickenburg, Yuma, Texas Hill, Maricopa, Pantano and Benson, Ariz., Mojave, Boca and Mammoth Tank, Cal., and Toano, Nev., none; La Mesilla, N. M., trace; Sorroco, N. M., 0.01 inch; Florence, Arix., 0.03; Deer Lodge, Mont., 0.05; Newhall, Cal., 0.06; Prescott, Ariz., 0.10; Stockton, Tex., 0.13; Davis, Tex., 0.14; Hot Springs, Nev., 0.15; Ravenna, Cal., 0.18; McKavitt, Tex., 0.19; Phœnix, Ariz., 0.20; Wadsworth, Nev., Cheyenne and Santa Fe, 0.22; El Paso, 0.24; Ft. Wingate, N. M., 0.25; Anaheim, Cal., 0.28; Pioche, 0.29; Wells, Nev., Rock Creek, Mont., and Laredo, Tex., 0.31; Golconda, Nev., and Ft. Snelling, Minn., 0.32; Ft. Grant, Ariz., 0.33; San Fernando, Cal., and Eagle Pass, Tex., 0.34; Key West, 0.35; Ft. Keogh, Los Angeles, and Portland, Or., 0.36; Brackettsville, Tex., 0.39; Elko, Nev., 0.41; Ft. Wallace, Kan., and San Diego, 0.45; Ft. Garland, Col., 0.46; Browns, Cal., 0.47; Ft. Shaw, Mont., 0.49; Ft. Custer and Concho, 0.51; Punta Rassa, 0.52; Campo, Cal., 0.53; Lemoore, Cal., 0.54; Ft. Hartsuff, Neb., 0.66.

Rainy Days.—The number of days on which rain or snow has fallen varies as follows: New England, 9 to 18; Middle Atlantic States, 10 to 15; South Atlantic States, 7 to 12, Eastern Gulf States, 5 to 12; Western Gulf States, 10 to 12; Ohio valley and Tennessee, 12 to 20; Lower Lake region, 15 to 22; Upper Lake region, 11 to 20; Upper Mississippi valley, 10 to 18; Missouri valley, 11 to 16; Valley of the Red River of the North, 12 to 19: Texas, 1 to 9; Rocky Mountains, 2 to 10; Middle Plateau, 3 to 16; Southern Plateau, 0 to 5; California, 3 to 14; Oregon, 6 to 14; Washington Territory, 7 to 19.

Cloudy Days.—The number varied in New England from 2 to 13; Middle Atlantic States, 3 to 13; South Atlantic States, 5 to 13; Eastern Gulf States, 2 to 12; Western Gulf States, 8 to 12; Ohio valley and Tennessee, 10 to 16; Lower Lake region, 12 to 19; Upper Lake region, 11 to 16; Upper Mississippi valley, 12 to 15; Missouri valley, 9 to 12; Valley of the Red River of the North, 10 to 12; Texas, 1 to 10; Rocky Mountains, 3 to 15; Middle Plateau, 8 to 19; Southern Plateau, 0 to 5; California, 2 to 12;

Rain or Snow from a Cloudless Sky.—Colorado Springs, Col., 17th.

Snow.—No precipitation of this nature was reported from the country to the south and east of the 35th parallel and the 104th meridian, respectively, except in extreme northern Texas on the 11th and 15th, and the extreme western portion on the 6th and 10th. In California none was reported except along the mountain ranges to the northeast of Los Angeles and east of Sacramento. In the various other districts snow fell on the following dates: *New England*, 1st to 5th, 11th to 28th; *Middle States*, 1st, 2nd, 13th to 25th; western *North Carolina*, 3rd, 12th, 13th; *Tennessee and the Ohio valley*, 1st to 5th, 12th to 28th; *Lower Lake region*, 1st to 5th, 8th, 9th, 12th to 28th; *Upper Lake region*, 1st to 28th; *Upper Mississippi valley*, 1st to 28th; *Missouri valley*, 1st, 2nd, 4th to 28th; *Indian Territory*, 10th, 11th, 15th, 18th, 20th; *Rocky Mountains*, from southern New Mexico to northern Montana, 1st to 28th; *Arizona*, (central part), 9th, 17th, 18th; *Middle Plateau*, 5th, 7th to 18th, 25th, 26th; *Northern Plateau*, 1st, 2nd, 8th to 16th, 18th, 20th, 26th, 27th; *Northern Pacific Coast region*, 8th, 12th to 18th, 26th to 28th.

Largest Monthly Snow-falls.—Mt. Washington, 56 inches; Beloit, Wis., 42; Little Mountain, Ohio, 38; Cisco, Cal., 33; Sterling, Ill., 32; Rockford, Ill., 31.5; Geneseo, Ill., 30; Elmira, Ill., and North Volney, N. Y., 29; Coldwater, Mich., 28; Friendship, N. Y., and Olivet, Dak., 26; Bloomfield, Wis., Marshall, Mich., and Cleveland, 25; Belvidere, Ill., and Corning, Mo., 24.5; Neillsville, Wis., Niles and Northport, Mich., 23; Minneapolis, Min., and Pierce City, Mo., 22; Deer Park, Md., 21.

The following items regarding the remarkably severe snow-storms of the month will be found of interest: *Dakota*: Fort Bennett, 12th, snow-fall unprecedented; cattle suffering dreadfully; travel of all kinds almost impossible throughout month. Yankton, 7th, heavy blockade; business almost suspended; great suffering among people in interior towns for want of food and fuel; 25th, all roads again blockaded. *Illinois*: Morrison, month characterized by an unusual fall of snow and consequent heavy blockades. *Iowa*: Nora Springs, 4th to 7th, worst snow blockade experienced in this section for past 15 years. Logan, 5th, 6th, terrible snow-storm, worst in 20 years. Burlington, 12th, 18th, all roads blockaded; heaviest for many years. Keokuk, 12th, 14th, railroads blockaded; much damage to property. Dubuque, 7th to 13th, telegraph wires down in all directions; streets impassable; all travel ceased; the worst blockade for many years. *Kansas:* Creswell, 11th, snow blockade most severe for 10 years; travel of all kinds impossible. Wellington, 10th, 11th, heaviest snow-storm ever experienced. Dodge City, 11th, very severe "blizzard," stopping travel of all kinds; cattle suffering severely; 14th, trains blockaded; all travel ceased; thousands of starving and freezing cattle found along the railroad; large herd of antelopes forced into town in search of food. Leavenworth, 11th, heaviest snow-storm for many years; streets impassable. *Michigan:* Northport, 27th, 16 inches fell and drifted terribly; travel impossible; worst ever experienced. Marquette, 12th to 28th, heaviest storm for years; telegraph lines all down; blockade still continuing. *Minnesota:* New Ulm, 27th, heaviest snow blockade ever experienced; hundreds of families suffering for want of food and fuel; travel impossible. St. Paul, 1st, to 16th, one continuous and uninterrupted blockade; much damage and suffering; violent blizzards. *Nebraska:* North Platte, 14th, heaviest storm for years; cattle dying from cold and starvation. Omaha, 6th, most violent storm for many years; telegraph wires all down; trains blockaded; all travel ceased; much damage to buildings; 12th, all railroad travel blockaded by heavy drifts. *New York:* 3rd, railroads on Long Island blockaded; storm very violent. *Ohio:* Sandusky, 1st, trains blockaded and business entirely suspended for the day. *Wisconsin:* Embarrass, 27th, worst snow blockade ever experienced; no mail; no trains; no travel of any kind. La Crosse, 7th to 17th, all communication seriously obstructed; heaviest storm for many years; great suffering and much loss to property.

Snow on Ground at End of Month.—North of the 37th parallel the following depths in inches were reported in the various States and Territories: *Maine*, 3 to 18; *New Hampshire*, 8 to 24; *Vermont*, 1 to 20; *Massachusetts*, 3 to 18; *Connecticut* and *Rhode Island*, trace to 2; *New York*, trace to 22; *New Jersey*, trace to 28; *Pennsylvania*, 5 to 16; *West Virginia*, trace to 3; *Ohio*, ¼ to 25; *Indiana*, trace to 4; *Michigan*, lower peninsula, 3 to 48, upper peninsula, 12 to 36; *Illinois*, 1 to 18; *Wisconsin*, 16 to 38; *Missouri*, trace to 5; *Iowa*, ¼ to 26; *Minnesota*, 24 to 36; *Kansas*, drifts; *Nebraska*, trace to 12; *Dakota*, 3 to 33; *Colorado*, only 2 inches on summit of Pikes Peak, trace to 12 in lower surrounding country; *Montana*, 2 to 22; *Wyoming*, trace to 12; *California*, on mountain ranges.

RELATIVE HUMIDITY.

The percentage of mean relative humidity for the month ranges, as follows: New England, 65 to 78; Middle States, 66 to 84; South Atlantic States, 58 to 81; Eastern Gulf States 51 to 75; Western Gulf States, 62 to 79; Ohio Valley and Tennessee, 64 to 74; Lower Lake region, 72 to 79; Upper Lake region, 66 to 83; Upper Mississippi valley, 71 to 78; Missouri valley, 66 to 87; Valley of the Red River of the North, 75 to 91; Texas, 61 to 72; Middle Plateau, 43 to 74; Southern Plateau, 30 to 47; California, 62 to 82; Oregon, 80 to 82. *High stations* report the following percentages not corrected for altitude: Mt. Washington, 78.9; Pike's Peak, 62.3; Denver, 56.9; Cheyenne, 50.4; Eagle Rock, 78.5; Santa Fe, 56.8.

WINDS.

The prevailing winds during the month of February, 1881, at Signal Service Stations, are shown on chart No. II, by arrows which fly with the wind. Along the Atlantic coast, from Maine to North Carolina, in the interior of the Middle Atlantic States, throughout the Upper Mississippi and Missouri valleys and in the Middle Eastern Rocky Mountain slope they were *northwesterly*. In the South Atlantic and Gulf States and in the interior of Texas and New Mexico, *north* to *east*. In the Lake region, Tennessee and the Ohio valley, *south* to *east*. In the Pacific coast and Plateau regions, *southeast* to *southwest*.

Total Movements of the Air.—The following are the largest total movements at Signal Service stations: Mt. Washington, 27,190 miles; Pike's Peak, 18,109; Cape May, 13,118; Portsmouth, N. C., 13,041; Kittyhawk, 12,464; Cape Hatteras, 12,158; Delaware Breakwater, 12,046; New Shoreham, 11,056; Chincoteague, Va., 10,963; Thatcher's Island, 10,782; Cape Henry, 10,459; Wood's Holl, 9,981; Indianola, 9,912; Sandusky, 9,878; Barnegat, 9,784; Ft. Macon, N. C., 9,783; Milwaukee, 9,172; Champaign, Ill., 9,109; Cheyenne, 9,061. The *smallest* are; Roseburg, Or., 1,722 miles; Silver City. N. M., 1,980; Visalia, Cal., 2,011; Phœnix, Ariz., 2,066; Salt Lake City, 2,072; Memphis, 2,092; Florence, Ariz., 2,115; Ft. Missoula, Mont., 2,240; Deadwood, 2,348; La Mesilla, 2,400; Lewiston, Idaho, 2,493; Lynchburg, 2,588; Helena, 2,843; Laredo, Tex., 2,932; Uvalde, Tex., 3,017; Spokane, Wash. Ty., 3,254; Olmypia, 3,261.

High Winds.—Winds of 50 miles and over were reported as follows: On summit of Mt. Washington, 1st to 3rd, 8th to 28th; on five of these dates the wind reached a velocity of 100 miles per hour; maximum wind velocity of 110 miles SE. on the 12th. On summit of Pike's Peak, 1st, 2nd, 4th, 11th, 12th, 15th, 16th, 20th, 21st, 26th to 28th; maximum wind velocity 80 miles W. on the 21st. Umatilla, 55 W., 25th. Ft. Shaw, Mont., 50 SW., 1st. Moorehead, Minn., 62 SE., 4th. Sandusky, 64 NE., 1st. Indianola, 51 N., 11th. New Orleans, 52 SE., 6th. Mobile, 60 SE., 6th. Portsmouth, N. C., 52 NW., 1st. Kitty Hawk, 52 N., 1st. Delaware Breakwater, 58 S., 12th. Cape May, 55 NW., 16th. Wood's Holl, 52 SE., 28th.

Local Storms.—During the passage of low-area No. VI northeastward over Tennessee and the Ohio valley on the 18th, opposing northerly and southerly winds, accompanied by high contrasts of temperature, prevailed in the southwest quadrant; the latter ranging from 35° to 45° between southern Illinois and the central portion of Alabama and Mississippi. Under these peculiar atmospheric conditions there occurred, quite late in the day and within the central portion of Alabama, a terrific tornado, which passed over a part of Tuscaloosa county. Its path extended from southwest to northeast, a distance of about 15 miles, and was characteristically narrow. The storm cloud, as usual, was accompanied by a loud roaring noise and a rotary motion from right to left. Several persons reported in connection with the passage of the cloud the presence of large balls of fire which sparkled and flashed in the belt of the wind, and seemed to be of all sizes, from the dimensions of an egg up to that of a half-bushel measure. Hail and rain followed in the track of the storm. The largest trees were twisted off near the stump or violently uprooted, and over twenty buildings were either unroofed or demolished. Heavy objects were conveyed long distances and the debris of buildings and fences was invariably carried from the east around by the north to the west, and thence by the south to the east. This storm passed but a little south and east of the track of many previous tornadoes which have traveled across this portion of the State in the same general direction.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for February, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verification to be 88.2 per cent. The percentages for the four elements are: Weather, 90.2; Direction of the Wind, 85.5; Temperature, 89.9; Barometer, 87.1 per cent. By geographical districts they are: for New England, 87.9; Middle States, 90.9; South Atlantic States, 92.2; Eastern Gulf States, 87.9; Western Gulf States, 91.1; Lower Lake region, 84.7; Upper Lake region, 87.5; Tennessee and the Ohio valley, 88.8; Upper Mississippi valley, 84.9; Lower Missouri valley, 84.0; Northern Pacific coast region, 85.4; Central Pacific coast region, 86.8; Southern Pacific coast region, 100.0. There were 117 omissions to predict (35 being due to the absence of reports from the Pacific coast) out of 3,444 or 3.40 per cent. Of the 3,327 predictions that have been made, 61, or 1.83 per cent, are condered to have entirely failed; 59, or 1.77 per cent, were one fourth verified; 342, or 10.28 per cent, were one-half verified; 464, or 13.95 per cent, were three-fourths verified; 2,401, or 72.17 per cent, were fully verified, so far as can be ascertained from the tri-daily reports.

Cautionary Signals—113 Cautionary Signals were displayed during the month, of which 107, or 94.7 per cent, were fully justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of, the station. 73 Off-shore Signals were displayed, of which 69, or 94.5 per cent, were fully justified; 72, or 98.6 per cent, justified as to direction and 70, or 95.9 per cent, justified as to velocity. Forty-three of the Off-Shore were changed from Cautionary. 6 "Northwest" Signals displayed on the Lakes were all justified. 192 Signals of all kinds were displayed, of which 182, or 94.8 per cent, were fully justified. The above does not include signals ordered at display stations where the velocity is only estimated. Thirteen signals were ordered late.

The Northwest Signal referred to above was instituted by the following order:

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
WASHINGTON, D. C., *November* 16, 1880.

CIRCULAR.

On and after January 1, 1881, an additional Cautionary Storm Signal will be displayed, as occasion may require, at all active Signal and Display stations of the Signal Service on the Lakes. This signal will be displayed at and on the regular place and staff, and will consist of *a white flag with a black square in the centre*, shown above *a red flag with a black square in the centre* by day, or a *white light* shown above a *red light* by night. This signal will be known as the "CAUTIONARY NORTHWEST SIGNAL," and will indicate, when shown, that at the port or place where displayed it is anticipated that the winds will be dangerous, and will blow from the north or west or from a direction between those points. The display of this signal will generally follow, and must be distinguished from the display of the usual "Cautionary Signal," *i. e.*, a red flag with a black square in the centre by day, or a red light shown at night, which retains, whenever shown, its usual meaning. *The display of either signal is always cautionary.* The "CAUTIONARY SIGNAL, *i. e.*, a red flag with a black square in the centre by day, or a red light at night, calls for caution in view of an approaching storm, and is "CAUTIONARY" WITH REFERENCE TO WINDS BLOWING FROM ANY DIRECTION.

The "CAUTIONARY NORTHWEST SIGNAL," *i. e.*, a white flag with a black square in the centre, shown above a red flag with a black square in the centre, by day, or a white light shown above a red light, by night, will indicate, when shown, that the storm disturbance is not considered as yet passed for the port or place where it is displayed, and that the winds

may yet be high, and the signal is "CAUTIONARY" WITH REFERENCE TO WINDS EXPECTED TO BLOW FROM THE NORTH OR WEST OR FROM A DIRECTION BETWEEN THOSE POINTS, at or near the place at which it may be displayed.

The order to display signals will be accompanied with a brief message giving the location and probable movement of storm-centre, the direction, and anticipated changes in the direction and force of the wind in the Lake region, and when practicable, for each Lake. The observers incharge of Signal stations on the Lakes, as well as all displaymen, will bulletin the order to display signals as well as the accompanying message, and any succeeding explanatory message, at such points as will secure the greatest publicity to the shipping interests, and will take any other steps that will ensure the greatest distribution to the parties interested in this information.

R. C. DRUM,
Adjutant General, and
Acting Chief Signal Officer of the Army.

NAVIGATION.

Stage of Water in Rivers.—In the table on the right-hand side of chart No. III are given the highest and lowest stages of water, as observed on the Signal Service river-gauges, during the month of February, 1881. With the exception of the Red River, in which the range, though considerable, was quite evenly distributed through the month, there have been very high and rapid rises in the navigable rivers. The Arkansas at Little Rock rose very rapidly from the 6th to 20th reaching its highest point on the latter date. The Mississippi at stations below St. Louis reached its maximum stage between the 24th and 28th; at Cairo, on the former date, the water reached a point 2 feet and 6 inches above the danger line. In the Ohio the highest stage was reached between the 11th and 17th, the water at Cincinnati rising 9 inches above the danger line on the 16th, and at Pittsburg 38 inches above on the 11th. The Cumberland at Nashville reached its highest stage on the 23rd and the Tennessee at Chattanooga on the 13th. At Morgantown and Pittsburg, on the Monongahela, the changes were rapid and very dangerous, the maximum stage being reached on the 10th and 11th. On the Pacific coast the navigable rivers north of San Francisco reached the highest stage of water between the 4th and 7th.

Ice in Rivers and Harbors.—The following items, relative to the formation of ice in such bodies of water throughout the northern section of the country, exhibit the same for the month of February, 1881. The Missouri and that portion of the Mississippi river from Keokuk northward have remained frozen during the month. At all Lake stations ice is reported firm and navigation closed. *Columbia River.*—Umatilla, Or., 1st to 4th, full of floating ice; 6th, free of ice, navigation resumed. *Umatilla River.*—Umatilla, Or., 1st to 4th, full of floating ice; 6th, free of ice. *Yellowstone River.*—Ft. Keogh, 28th, frozen over during month, but now threatening to break up. *Powder River.*—Ft. Keogh, 28th, frozen over during month, but now threatening to break up. *Missouri River.*—Leavenworth, 6th, ice rising and cracking along banks: 7th, ice gorged; 8th, ice settled and again solid; 28th, ice 20 inches in thickness, teams crossing daily. *Kansas River.*—Lawrence, 7th, frozen over since November 18th, 1880; 8th to 16th, partly open; 17th to 28th, frozen over. *Des Moines River.*—Keokuk, 10th, river open to its mouth, ice gorged two-thirds the way across the Mississippi. *Mississippi River.*—Keokuk, 5th, to 26th, teams crossing on ice. St. Louis, 1st, ice gorged in Carondalet harbor; 3rd, ice solid above and below bridge, people crossing; 4th, one mile of gorge in Carondalet harbor moved out; 7th, river clear south of bridge; 8th, gorge above bridge, intact and covered with water; 9th, gorge gave way about noon, several boats damaged; 10th to 28th, river full of heavy floating ice; 15th, steamer "City of Granville" arrived from the south, first vessel since November 16th, 1880; 16th, ferries stopped by heavy floating ice. Dubuque, 28th, ice in river 32 inches in thickness. Cairo, 1st to 7th, river frozen over; 8th to 24th, full of floating ice; 14th, navigation resumed; 25th, entirely clear. Memphis, 14th, floating ice, water rising rapidly, endangering property. *Chicago River.*—Chicago, 9th, ice breaking up and passing out. *Eel River.*—Logansport, Ind., 6th, ice 22 to 25 inches thick; 10th, ice broke up and passed out, causing great destruction to bridges and other property. *Wabash River.*—Logansport, Ind., 10th, ice passed down river, occasionally interrupted by heavy gorges; the destruction to property almost without parallel. *St. Clair River.*—Port Huron, 9th, ice breaking up and passing down into St. Clair Flats. *Maumee River.*—Perrysburg, 9th, ice breaking up and forming heavy gorges; 10th, gorge broken, but formed at a point four miles below. Toledo, 11th, 7 p. m., ice gorged above city, 10 p. m., gorge broke, flooding a portion of city to the depth of several feet; six schooners loaded with wheat carried down by the ice through the railroad bridges, destroying a span of each bridge; 12th, gorged below city, backing up the water, flooding Water street to a depth of six feet, Island House and Lake Shore depot flooded, freight cars submerged, cellars filled, the water rising above the lower floors of dwellings, business entirely suspended; 14th, ice gorge intact, flood still continues, damage to property estimated at $3,000,000. *Ohio River.*—Cincinnati, 1st to 15th, full of floating ice; 16th to 28th, clear. Vevay, Ind., 3rd, full of floating ice, great difficulty in landing, navigation suspended; 6th, full of heavy ice, no arrival of boats; 9th, large number of steamers passing southward, ice nearly disappeared; 11th, 12th, heavy ice, navigation suspended; 16th, ice rapidly disappearing, boats resumed trips. Louisville, 6th, river full of floating ice; 7th, mail boats stopped running; 8th, river clear. Portsmouth, Ohio, 2nd, heavy floating ice, navigation closed; 9th, navigation opened; 13th, heavy floating ice, navigation again closed; 15th, navigation open, river partially clear. *Cuyahoga River.*—Cleveland 9th, ice breaking up, but current not strong enough to carry it out to lake; 10th, gorged

at mouth, the ice being packed solid to the bottom, water rose at the rate of one inch per minute, soon overflowing wharves and warehouses, gorge finally broken by the firing of artillery; 11th, ice in Lake still solid. *Sandusky Bay.*—Sandusky, 10th, ice remains solid. *Detroit River.*—Detroit, 9th, floating ice; 10th, river clear. *Louisville and Portland Canal*—Louisville, Ky., 6th to 10th, frozen over; 11th, ice breaking up; 14th, clear of ice. *Monongahela River.*—Pittsburg, 10th, ice gorged, causing considerable damage to property. Morgantown, 1st, ice breakbreaking up; 3rd, gorged, carrying away river guage, most extensive and destructive gorge ever experienced; 10th, gorge broke and passed down. *Genesee River.*—Rochester, 10th, ice breaking up; 11th, river clear, but rising rapidly and flooding the low lands; 12th, gorged below the Lower Falls. *Oswego River.*—Oswego, N. Y., 12th, ice gorged above the bridge, no serious damage resulting. *Susquehanna River.*—Catawissa, Pa., 10th, "North Branch" has remained solid for the past 76 days; 11th, commenced breaking up acd finally passed out without appreciable damage to property. Milton, Pa.,10th, "West Branch," ice breaking up, Limestone Run overflowing; 11th, heavy floating ice, river rising rapidly; 12th, floating ice, river rose 17 feet, no serious damage; 13th, river clear and falling. *Potomac River.*—Washington, D. C., 12th, ice broke up, carrying away about 600 feet of the "Long Bridge," lower portion of city flooded, causing great damage to property. *Chincoteague Bay.*—Chincoteague, Va., 1st to 10th, closed with ice; 9th, large fields of ice extending north and south and several miles out to sea; 11th, ice breaking up and passing out rapidly. *Delaware Bay.*—Delaware Breakwater, 2nd, gorged with ice as far as the eye could reach; 3rd, steamer "D. J. Foley" ice bound opposite station and leaking badly; 7th, ice outside breakwater commenced moving; 9th, ice leaving and returning to the harbor with the movement of the tides; 11th, harbor full of floating ice; 13th, harbor entirely clear. *Pamlico Sound.*—Portsmouth, N. C., 3rd, frozen over to the channel. *Core Sound.*—Cape Lookout, N. C., 1st to 3rd, ice formed, sufficient to stop navigation. *Chesapeake Bay.*—Cape Henry, 6th, large quantities of ice floating out to sea. Baltimore, 1st to 6th, heavy floating ice, navigation dangerous: 10th, navigation closed; 11th, upper harbor clear, river frozen solid from shore to shore except portion of channel near mouth, ice in bay passing out; 13th, river and bay clear of ice, navigation reopened; 14th, harbor entirely clear; 21st, Bay Line steamers resumed regular trips. *Little Egg Harbor.*—Little Egg Harbor, N. J., 3rd, 4th, sound nearly frozen over; 8th, 9th, ice breaking up but tides too low to carry it out; 12th, ice drifting badly, navigation impossible; 13th, sloop "Mary E. Mott" damaged by ice and abandoned; 15th, ice passing out, telegraph cable carried away; 17th, clear of ice. *Delaware River.*—Trenton, N. J., 1st to 12th, frozen over; 13th, ice breaking up and passing down. *Hudson River.*—Garrisons, N. Y., 28th, river still frozen over, teams crossing or driving on the ice to neighboring towns. *New York Bay.*—New York City, 1st to 3rd, heavy floating ice, seriously impeding navigation; 4th, clear of ice; 18th, heavy floating ice in river and bay. *Long Island Sound.*—3rd, sound nearly frozen over, navigation closed. New Haven, 4th, navigation seriously impeded by heavy floating ice, steamers report 60 miles of ice from Hell Gate eastward. New London, 3rd, 4th, harbor full of ice, navigation suspended; 5th, ice breaking up along shore; 8th, first boat of the usual coal fleet arrived after a rough experience of 60 miles of heavy ice, first arrival since January 24th; 9th, ice breaking up along shore and running out; 11th, British steamers closed in ice since January 26th were towed out; 12th, light ship from Comfield Point cut adrift by the ice and found in a large floe near Plum Island; 25th, ice forming along shore; 28th, harbor full of floating ice. *Vineyard Sound.*—Wood's Holl, 1st to 4th, full of floating ice, navigation impossible; 8th, large number of vessels ice-bound in the harbors of Martha's Vineyard and Nantucket; 10th, full of floating ice, steamer "Island Home" ice-bound within a few miles of Nantucket. *Narragansett Bay.*—Newport, R. I., 1st, ice forming rapidly in inner harbor; 2nd, only the largest steamers can force their way through the ice; 7th, ice breaking up and passing out; 8th, boats resumed regular trips. *Massachusetts Bay.*—Boston, 1st to 3rd, large quantities of floating ice; 8th, ice nearly passed out; 13th, entirely clear. *Connecticut River.*—Hartford, 3rd, ice 36 inches thick, no signs of breaking up. *Passamaquoddy Bay.*—Eastport, Me., 10th, floating ice; 13th, clear.

Floods.—Under this heading it becomes necessary to note one of the most important features of the month, and in connection therewith to consider two predominating influences in the production of remarkably serious consequences that have resulted in a vast destruction of property, the counterpart of which has not transpired in some sections for 20 years. These two causative elements have been confined to different periods of the month and widely separated portions of the country. The first, a result of excessive precipitation, was experienced throughout the Pacific coast and Northern Plateau regions and along the Western Gulf coast between the 1st and 6th; the second, due to continued high temperatures, the maximum of the month, operated throughout the Ohio valley and Middle States, in northern Ohio and Indiana from the 10th to the 16th, suddenly releasing the ice bound rivers and converting the huge snow-drifts into torrents of water. The following reports will be found of interest: *California:* Red Bluff, 1st to 3rd, rivers and creeks rising rapidly; great damage to lumber companies; bridges and railroad tracks washed away; ranches suffered great loss from the destruction of fences, buildings and growing grain; stock killed; all communication suspended; 4th. Sacramento River reached 28 feet and 6 inches above low-water mark, highest point ever recorded. Sacramento, 4th, river rose to 26.5 feet above low-water

mark, highest ever recorded. Town of Washington flooded to a depth of 6 feet; most of the people removed to Sacramento for safety; for miles to the south and west the country was completely covered with water. Rio Vista, 1st to 5th, very heavy floods submerging all the cultivated islands in the Sacramento and San Joaquin rivers, probably rendering them unfit for cultivation for the next three years; 5th, water reached highest point or within 10 inches of the flood of January, 1862. Oroville, 3rd, highest water ever seen by the oldest inhabitant; several buildings carried away; the gas works, composed of brick buildings, wood-sheds and dwellings, entirely swept away; velocity of current was such that an engine weighing 1½ tons and set on heavy oak timbers was carried 100 yards; a galvanized tank, containing 1,000 gallons of crude oil, found 15 miles from works. *Oregon:* Umatilla, 1st to 3rd, Umatilla and Columbia Rivers rose very high; lowlands all flooded; buildings, fences and bridges swept away; great loss to railroad companies from the carrying away of cut timber. Throughout eastern Oregon the destruction of property has been enormous; among the farmers the loss is estimated at $300,000; in the city of Portland alone it will reach about $100,000, while the railroad companies have lost not less than $125,000. *Washington Territory:* Pomeroy, 1st, Pataha creek overflowed; water 2 to 4 feet deep in the streets; people departing for places of safety; 2nd, all bridges gone; roads impassable. *Idaho:* Boise City, 2nd, Cottonwood creek above its banks; streets covered with water; bridges, fences, side-walks and buildings carried away; cellar walls caved in; all communication and business closed. *Florida:* Pensacola, 6th, water highest ever known; wharves, bathing houses, business buildings, lumber yards and rafts of timber suffered great damage; over 100 vessels in harbor when storm began, many of which were seriously injured by dragging anchors, grounding and collisions. *Louisiana:* New Orleans, 6th, Lake Ponchartrain overflowed, water covering a large portion of city to a depth of three feet; worst storm for many years; 10,000 people thrown upon the mercies of the city; loss of property and suffering unprecedented; all railroad and telegraphic communication cut off. The settled portion of city inundated covers about five square miles and contains probably 50,000 inhabitants; in one-story houses everything was washed out. The loss of property along the coast of Mississippi Sound, from Bay St. Louis to Pascagoula, is estimated at over $100,000. Pass Manchac, 8th, terrific storm of wind and rain from the southwest, city completely drowned out; every building except the depot and telegraph office carried away. *Alabama:* Mobile, 7th, lower portion of city flooded, business entirely suspended; all communication by railroad or telegraph completely cut off by huge washouts and the destruction of bridges. *Illinois:* Lasalle, 11th, portion of Rock Island R. R. bridge swept away; Illinois River rose 12 feet above low-water mark, all the low lands submerged; barns and houses carried away; several families left homeless. Ottawa, 11th, highest water since the flood of 1856; all bridges on the Fox and Illinois Rivers more or less injured; water covers the bottom-lands and prairies for miles. *Indiana:* Crawfordsville, 10th, most disastrous freshet ever before experienced; mill-dams, bridges, fences and buildings carried away. Fredericksburg Pike, 11th, iron bridges across Walnut Fork and Shannondale Pike carried away; loss, $10,000 to $15,000. Sullivan, 10th, all streams flooding the country: Wabash River highest for many years: railroad bridge carried away; loss, $175,000. Marion, 10th, railroad bridge over the Mississnewa River carried away; all railroad and telegraphic communication cut off. Spencer, 10th, two spans of the State House quarry bridge carried away; much damage to other property. Indianapolis, 10th, Eagle Creek rose above its banks, carrying away buildings and drowning stock. Fall Creek very high and rising rapidly; people in vicinity compelled to abandon dwellings and ford the water, waist deep, to higher ground. Pogue's Run rose above the floors of the bridges and many crossings within the city limits, water nearly as high as the great flood of 1875. Mitchell, 11th, White river higher than during the great flood of 1875, water rising five inches per hour; great damage to fencing, outbuildings and growing crops. Dayton, 11th, Wild Cat creek higher than ever before, low lands entirely submerged, great damage to growing crops. Lafayette, 11th, Wabash river higher than ever before remembered, bottom lands covered to a depth of several feet, streets in lower portions of city submerged. Elkhart, 11th, all streams highest for many years, all railroad communication closed, tracks badly washed and bridges partially destroyed. Columbus, 11th, Clifty river highest ever known; portion of city flooded; large turnpike bridge over river river carried away, causing a loss of $50,000. *Ohio:* Toledo, 10th to 14th, most disastrous flood ever experienced; principal streets of the city submerged to a depth of from three to six feet; buildings floated from their foundations; bridges, sidewalks and fences carried away and hundreds of packages of mail matter soaked with water; entire losses reach into the millions. Compared with the great floods of 1847, 1855, 1866, 1869 and 1876 the water reached a higher point than ever before recorded, except in 1847 and 1866. Grand Rapids, 12th, highest water for many years; city partially flooded; bridges and fences carried away. Napoleon, 11th, water higher than the great flood of 1867; much damage to property. Canton, 10th, streets flooded, streams higher than for many years past, bridges carried away and all railroad traffic suspended; county roads impassable, much damage in the agricultural sections. Columbus, 10th, all streams overflowed; much damage to bridges, fences and buildings; all railroad and telegraphic communication suspended; Scioto river higher than during the great flood of 1869. Wellsville, 11th, part of the town completely submerged, water in some of the streets six feet deep, several bridges carried away. Steubenville, 11th, water 37 feet above low-water mark,

lower part of city inundated; people of New Cumberland, on opposite side of river, compelled to flee to high ground for safety. Marietta, 11th, water 38 feet above low-water mark, streets flooded, river nearly a mile wide, much damage to bridges and buildings. Cleveland, 10th, highest water for many years; streets, wharves and warehouses flooded. Warren, 11th, Makoning river highest for many years, whole south end of city one vast lake, 1,500 people obliged to leave their dwellings, nearly all of the manufactories of the city were flooded, business generally suspended. New Comerstown, 11th, Tuscarawas river higher than for the past 30 years, railroad trains discontinued, bottom lands submerged and corn, hay, fodder and fences carried away. Dayton, 11th, highest water since the great flood of 1866; houses in northern part of city flooded; water rapidly approaching the southern portion, where many people left their houses for places of safety. Sidney, 11th, Miami river highest for 13 years. Port Jefferson, 11th, iron bridge carried away; much damage to other property. Chagrin Falls, 11th, Chagrin river highest since the flood of 1878; great damage to farmers along the bottoms. Youngstown, 11th, water highest since flood of 1878; 50 to 60 dwellings flooded and abandoned; business suspended; all communication cut off; all bridges throughout the county more or less damaged, causing a loss of about $20,000. Bucyrus, 11th, Sandusky river above its banks; railroad bridge carried away; much damage in city and country round about. Mt. Vernon, 11th, Kokosing river highest for many years; great damage to bridges, fences, buildings and other property. Newark, 11th, heavies flood for many years; great destruction to county bridges; farmers suffered heavy losses. Lorain, 11th, Black river overflowed and highest for years; great damage to property in the low lands; several bridges carried away. Delaware, 11th, highest water ever known; several mill-dams carried away. *Pennsylvania:* Harrisburg, 10th, Susquehanna and Juniata rivers rose at the rate of two feet per hour; railroad tracks, for the distance of a mile, submerged to a depth of three feet. Meadville, 11th, highest water for years; 200 families compelled to abandon their houses; all cellars in the business part of the town flooded, causing great loss to merchants; all railroad and telegraphic communication cut off; several bridges carried away. Oil City, 11th, everything flooded; great damage to property; bridges and railroad tracks washed out. Washington, 11th, Chartier's creek overflowed; water rising 12 inches per hour; bridges, fences and buildings carried away. Woodville, 11th, water highest ever known; families compelled to leave their dwellings on horseback or in boats. Cannonsburg, 10th, highest water for many years; many dwellings abandoned for places of safety; great loss of property and much suffering. Hamilton, 11th, Juniata river highest for years, bridges carried away and all railroad and telegraphic communication cut off; throughout Dauphin county the damage done by small streams is very great, nearly all of the bridges have been distroyed and travel of all kinds seriously impeded. Wilksbarre, 11th, Susquehanna river twenty feet above low-water mark, several bridges destroyed, the flats opposite the city were entirely under water and many telegraph poles were carried away. Newport, 11th, Juniata river very high, portion of bridge carried away, many families have abandoned their houses for places of safety. Schuylkill Haven, 11th, all of the lower portion of city submerged, water rose so rapidly that many people were obliged to take refuge in upper rooms of their houses until boats were procured to convey them to places of safety. Milford, 11th, Delaware river highest ever known, portion of city flooded, great destruction. *West Virginia.*—Parkersburg, 11th, river 32 feet above low-water mark and rising at the rate of five inches an hour. Pomeroy, 11th, river 34 feet above low-water mark and rising at the rate of six inches an hour. Point Pleasant, 11th, river 30 feet above low-water mark and rising rapidly. Charleston, 11th, Kanawha river 18 feet above low-water mark and rising six inches per hour. Hinton, 10th, New river 10 feet above low-water mark and rising. *New York.*—Elmira, 11th, Chemung river and other streams in vicinity overflowed, highest water for several years, hundreds of acres in eastern part of city submerged and many dwellings deserted, people passing about in boats and upon rafts. Port Jarvis, 11th, Delaware river overflowed, lower portion of city flooded, many families leaving for places of safety, much damage to property here and throughout the Delaware valley. Rondout, 11th, all railroad communication suspended, very heavy floods and much destruction to property in Duchess and Columbia counties. Poughkeepsie, 11th, Wappinger's creek overflowed, several bridges carried away and much other damage done, on some of the country roads water was eight feet deep. Lackawaxen, 11th, river 25 feet above low-water mark and rushing by with fearful velocity carrying everything before it, much destruction of property. *North Carolina.*—Elsworth, 7th to 9th, all streams highest for years, large washouts and heavy land slides along railroad tracks, much damage in surrounding country. *District of Columbia.*—Washington, 12th, Potomac river overflowed, lower portion of city completely inundated, water highest ever known, people passed about in boats in front of the Metropolitan hotel and about the Baltimore and Potomac depot, houses and stores flooded above the first floors. *Maryland.*—Woodstock, 12th, Patapsco river highest for several years.

High Tides.—Pensacola, Fla., 6th, highest ever known, water rose five feet above high-water mark New Orleans, 6th to 9th, very high. Indianola, 5th, unusually high. Galveston, 6th, very high. Mobile, 6th, remarkably high, flooding entire lower portion of city.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors at Signal Service stations, with

the average depth at which observations were taken, is given in the table on the left-hand side of Chart No. III. Owing to ice and breakage of instruments, observations are wanting as follows: Alpena, Burlington, Buffalo, Chicago, Cleveland, Detroit, Duluth, Escanaba, Grand Haven, Milwaukee, Marquette, Sandusky and Toledo, from 1st to 28th; Mobile, 19th to 28th; Delaware Breakwater, 2nd to 8th; San Francisco, 3rd to 28th; Punta Rassa, 18th to 28th.

ATMOSPHERIC ELECTRICITY.

Thunder storms.—In the various districts they were reported on the following dates: New England, 12th, 28th; Middle Atlantic States, 5th, 12th, 19th, 25th, 26th, 27th, 28th; South Atlantic States, 11th, 16th to 19th, 21st, 22nd, 23rd, 27th, 28th; Eastern Gulf States, 6th, 7th, 9th, 11th, 18th, 19th, 25th, 26th, 27th, 28th; Western Gulf States, including Texas, 5th, 6th, 8th, 9th, 10th, 11th, 15th, 16th, 17th, 18th, 19th, 20th, 26th; Ohio valley and Tennessee, 9th, 11th, 18th, 19th, 26th, 27th, 28th; Upper Lake region, 26th; Upper Mississirpi valley, 17th, 20th, 26th, 27th, 28th; Lower Missouri valley, 5th, 6th, 19th, 20th, 26th, 27th; Arizona, 5th, 6th, 17th; California, 3rd, 15th, 16th. The most important storm of the month, except along the West Gulf coast from 6th to 9th, began in the Lower Missouri valley on the 26th, accompanying low area No. X, and as it passed eastward spread over the entire country from the lakes to the Gulf, reaching the Atlantic coast on the 27th and 28th, where it was experienced from Havana, Cuba, northeastward to Maine. Storms of this class, gradually increasing in number and severity on the approach of spring, have been less frequent in the northern and more frequent in the southern sections of the country than during the month of February, 1880. As compared with the same month of previous years since 1873, the largest number were reported during February, 1881, the next largest in February, 1878, while in 1879 the number fellto near the minimum which occurred in 1875. It is very interesting, and still further there would seem to be an accordance with supposed laws of periodicity in connection with the recurrence of these storms from season to season, to note that in a comparative study of the month of February for the past nine years, it is found as an invariable feature, that about four-fifths of all the thunder-storms occurred between the 15th and 28th.

Auroras.—There were no remarkably brilliant displays during the month, but rather an unusual number were reported as having been witnessed over that portion of territory common to auroral manifestations, reaching from Maine westward to the 105th meridian. Displays of this nature were observed on the following dates: 1st, from stations in Nebraska northward to the northern boundary of the United States and in northern New England; 2nd, from Kansas northward to British America, and from Virginia northeastward to Maine; 20th, from Montana eastward to Lake Michigan and over New England. 26th, throughout Dakota and Minnesota, and in New Hampshire. 27th, from southern Kansas northwestward to Montana, northward to the northern boundary of Lake Superior and over New England. On all of these dates, and particularly the last three, extreme cloudiness prevailed over the Lower Lake region, preventing any display of auroras, even if they had occurred. From various stations local displays were witnessed on the following dates: Ft. Stevenson, Dak., 28th, a. m.; Spiritwood, Dak., 22nd, p. m.; St. Vincent, Minn., 16th, 20th, 22nd, p. m.; Duluth, 23rd, p. m.; Oswego, N. Y., 5th, a. m.; Burlington, Vt., 3rd, midnight to 12 15 a. m.; 3rd, 4.20 a. m. to daybreak; 6th, 2 a. m. to daybreak; 19th, 11.15 p. m. to midnight; Bangor, Me., 5th, p. m.; Eastport, 7th, 1 a. m. to 3 a. m.; Cambridge, Mass., 19th, 11 p. m.; Newburyport, Mass., 7th, 5 a. m.; 19th, p. m.; Gardiner, Me., 25th, midnight to 4 a. m.

Zodiacal Light.—Waterburg, N. Y., 19th, 21st; Flemington, W. Va., 9th; Bellefontaine, O., 19th; Clear Creek, Neb., 8th, 15th, 16th, 20th, 23rd to 27th; Somerset, Mass., 17th, 19th, 20th, 22nd to 25th; Cambridge, Mass., 15th, 16th, 17th, 19th, 22nd to 25th; Yates Center, Kan., 15th, 20th, 22nd, 23rd, 24th, 25th, 27th, 28th; Monticello, Ia., 21st, 22nd, 23rd; New Corydon, Ind., 16th, 19th, 21st, 23rd, 25th; St. Vincent, Minn., 15th, 16th, 17th, 20th, 24th; Springfield, Ill., 16th.

OPTICAL PHENOMENA.

Polar Bands.—New Corydon, Ind., 17th, 21st, 25th; Yosemite valley, Cal., 14th; Clinton, Ia., 19th; Yates Center, Kan., 1st, 7th, 19th, 20th; Gardiner, Me., 8th, 15th, 20th; Auburn, N. H., 11th, 15th, 20th, 27th; Freehold, N. J., 7th; Vineland, N. J., 7th; Wytheville, Va., 6th, 20th, 25th; Prescott, Ariz., 8th; Little Rock, 1st; Chicago, 4th.

Mirage.—Corpus Christi, Tex., 18th, 1:35 p. m., Mustang Island plainly visible, although at a distance of 18 miles. Genoa, Nebr., 1st, 21st, 27th, 28th. Albuquerpue, N. M., 16th. Indianola, 8th, 11th, 12th, 28th. Escanaba, 3rd, 4th.

Halos have been observed throughout the various districts with the usual frequency common to the winter months. Solar halos, accompanied with from two to four mock suns, were repeatedly witnessed at stations in the Rocky Mountain region, along the Eastern Slope and thence northeastward to the Upper Lake region. The most notable displays were reported from Denver and summit of Pike's Peak on the 14th, and from Menominee, Mich., on the 19th, the latter attended by five mock suns and a parhelic circle of 22° radius, was the most brilliant one of the month. Lunar

halos, with four mock moons, presenting a display of remarkable brilliancy and great perfection, were observed between 9 and 10 p. m. on the night of the 14th in central Coloroado, the stations of Pike's Peak, Denver and Colorado Springs having opportunity for complete observations. From Denver two paraselenæ were observed at points where the parhelic circle cut the halo of 22° radius and two where the intersection would have taken place if there had been present a halo of 90° radius; at a point about 85° above the horizon there appeared a brilliant inverted rainbow arch in the position where a halo of 46° radius would have passed.

MISCELLANEOUS PHENOMENA.

Earthquakes.—Salinas City., Cal., 2nd, (no time given,) motion from north to south; pendant bodies freely vibrated. Visalia, Cal., 1st, 4:11 p. m., three shocks in rapid succession, lasting altogether about two seconds; motion southeast to northwest; 9:53 p. m., another rapid succession of shocks, two in number, and continuing for about two seconds; vibrating motion from south east to northwest; force displayed less severe than former.

Meteors.—Mt. St. Helena, Cal., 11th, 7:30 p. m., very brilliant; course NE. to SW.; upon exploding produced a loud report, which was experienced for several miles around. San Francisco, 2nd, 9:45 p. m., very large and brilliant; passed over city to the northeast; color pale green. Deadwood, 19th, 11 p. m., very brilliant; course SE. to NW.; 27th, 11 p. m., course E. to W.; exploded with fragments like a rocket.

Sunsets.—The characteristics of the sky at sunset as indicative of fair or foul weather for the succeeding twenty-four hours have been observed at all Signal Service Stations. Reports from 174 stations show 4,846 observations to have been made, of which 22 were reported doubtful; of the remainder, 4,097 or 84.9 per cent. were followed by the expected weather.

Sun Spots.—The following record of observations, made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S Newcomb, U. S. Navy, Superintendent Nautical Almanac Office, Washington, D. C.:

Date—Feb., 1881.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups	Spots.	Groups	Spots.	Groups	Spots.	Groups	Spots.	
2, 10 a. m.	0	5	0	10	0	5	5	35†	
3, 9 a. m.	0	0	0	10	0	0	4	25†	
4, 9 m.	0	0	0	10	0	10	4	25†	Faculæ.
5, 9 a. m.	0	5	2	5	0	5	2	25†	Faculæ.
6, 10 a. m.	2	15	0	0	1	4	4	40†	Faculæ.
7, 1 p. m.	0	0	0	0	0	0	4	40†	
10, 3 p. m.	0	0	1	20†	0	0	3	15†	Spots probably disappeared by solar rotation.
11, 8 a. m.	1	3	0	3	0	0	4	15	Faculæ.
12, 10 a. m.	0	0	1	5	0	0	3	10	
13, 9 a. m.	0	0	0	0	0	0	3	10	Faculæ.
14, 9 a. m.	2	4	1	2	2	4	4	12	Faculæ.
15, 9 a. m.	2	5	0	0	0	0	6	17†	Faculæ.
16, 8 a. m.	0	5	0	0	0	0	6	20†	Broad areas of faculæ.
4 p. m.	0	0	0	0	0	0	6	20†	
17, 9 a. m.	1	5	0	0	0	0	6	25†	Faculæ. Two of the spots very large.
19, 4 p. m.	2	8	2	20†	2	8	6	13	
20, 10 a. m.	1	10	1	1	0	0	6	22	Faculæ. Two of the spots very large.
2 p. m.	0	0	0	0	0	0	6	22	
23, 8 a. m.	2	6	3	12	1	2	5	12	Faculæ. Spots probably disappeared by solar rotation.
25, 5 p. m.	0	0	0	0	0	0	5	10	
26, 9 a. m.	0	0	1	1	0	0	4	8	Faculæ.

† Approximated.

Mr. William Dawson, at Spiceland, Ind., reports: 2nd, three groups and about 25 spots; large spot at east edge and another at west edge. 13th, two large spots close together, midway between centre and west edge. 15th, six groups, 24 spots; faculæ at east side; air very good. 17th, six groups, 26 spots; large spot close to east edge. 19th, four groups, 9 spots; air poor; 21st, six groups, 23 spots, one large, 11 others quite prominent. 22nd, six groups, 45 spots; one very large spot alone in the SW. quadrant; best air for many weeks. 25th, five groups, 16 spots; new group and faculæ at east edge; faculæ at west edge; air middling good.

Mr. H. D. Gowey, at North Lewisburg, Ohio, reports: saw sunspots every day except on the 4th, 6th, 8th to 10th, 12th, 13th, 18th, 20th, 27th and 28th, when it was too cloudy for observation.

NOTES AND EXTRACTS.

[From the Popular Science Monthly, March, 1881.]

Climatology of Europe.—The climate of Western Europe is ameliorated by the warmth of the Gulf Stream in winter, and by the neighborhood of the ocean in summer. In Eastern Europe these modifying influences cease to be felt, and the climate gradually assumes a continental character, with greater differences of temperature, colder winters and warmer summers. The differences in the summer temperatures of the eastern and western regions are less marked than those in the winter temperatures, and amount at most to about 27°. For the greater part of the continent the

differance in the temperature of July is not more than about 18°. The mildest summers are felt in Ireland and Norway, and the hottest in Southeastern Europe. The difference is perceptible between places in corresponding latitudes in the southeast and southwest. Thus, Syracuse is 7° and Sebastopol is 5½° warmer in July than Lisbon and Oporto. A similar difference, but less in extent, appears in going eastward along the northern parallels. The differences in the winter temperatures of the several parts of the continent are much more marked than are those of the summer temperatures. The mildest winters are felt along the Mediterranean coast and in the Iberian Peninsular, where the mean temperature in January is from 16° to 19°. The next mildest are those of the western coast of France and the southern coast of England and Ireland. The winters of western Scotland and the Orkney and Faroe Islands are milder than those of Berlin and Milan; those of the Arctic coasts of Scandinavia than those of the Gulf of Bothnia, as is shown by the fact that the Arctic fiords of Norway, even as far as North Cape, are not frozen, while the Gulf of Bothnia is regularly frozen in winter. In Russia the January temperature diminishes as we go east, so that, while it is about 24° at Warsaw, it is reduced to 4° at Uralsk. The highest annual mean temperature, the mildest winters and the warmest summers, must be looked for where the land approaches the thirty fifth parallel, at the southern points of Spain, Sicily, and C ete. The highest known mean in Europe is at Catania, 65°, the temperature of January being there 51°, and that of August 81°. Gibraltar enjoys a warmer temperature in January, 54°, nearly corresponding with the temperature of Cairo. The January of Catania is like that of the end of April. the January of Gibraltar like that of the first half of May, in Berlin. These extreme southern points suffer, however, occasionally from frost and snow. Snow fell on the African coast in 1845 and 1850, and in the latter year a temperature below the freezing-point was observed as far south as the Sahara; and the Nile is said to have been frozen in the year 859. So it is safe to assume that no place in Europe is secure from snow and frost.

[From the American Journal of Science, February, 1881.]

Ocean Temperatures in the Arctic—Observations taken on the S. S. Gulnare, by O. T. Sherman.—The following observations were taken on the Arctic S. S. Gulnare, during the summer of 1880. A Miller-Cassella thermometer was employed; its scale errors, carefully obtained, have in each case been applied. The steamer, at the time of making the observations, lay becalmed. If we refer to the older maps we see that on some the warm waters which render the west coast of Greenland habitable are connected with the Arctic current which renders the east coast barren. On others the warm current is shown at once as a branch of the Gulf Stream. On the newer German maps the currents are shown overlapping in about latitude 61° N. The following table serves to give confirmation to this latter representation, and also indicates the limits and depth:

Table I.—Deep Sea Temperatures.

Depth in fathoms.	Lat. 60° 6′ N. Long. 56° 36′ W.	Lat. 57° 33′ N. Long. 55° 15′ W.
0	41°.9 F.	45°.0 F.
10	41°.8	.....
20	40°.0	.....
30	.....	45°.0
60	39°.9	40°.0
90	.....	39°.9
110	38°.8	.....
150	38°.2	40°.0
270	40°.8	.....
310	40°.8	.....

The sudden rise in temperature at the lowest depths naturally caused some surprise to the observer, and was therefore measured three times. These observations may also in part explain the bend in the curve representing the limit of ice.

Phenomena of some rarity in the surface temperatures and densities were also observed by us. When passing in front of a glacier outlet, or across the track of an ice pack, we suddenly entered a body of water much colder and fresher than that surrounding it. The ice in each case readily suggested an explanation. Our interest was more excited at the depth of the freshened water, for the engineer found indefinitely the same changes of density in the water he took into the boiler about ten feet below the surface. On one occasion we had to sink a thermometer ten fathoms before obtaining indications of a rise in temperature.

It is true that the outcropping of the Arctic current would give similar phenomena, but to one on the spot the change was always seen to be connected with the melting of the ice.

Table II.—August 4, 1880.

Position.	Hour.	Surface Temperature.	Density Hydrometer. Scale reading.	Remarks.
	5	44°.0	4°.0=1.027316	
	6	46°.0	4°.0=1.027383	
	7	46°.0	4°.0=1.027383	
	8	35°.5	2°.5=1.016492	A deep-sea Thermometer sunk 10 fath's, read 40°.0.
	9	36°.0	2°.8=1.018644	
	.....	.....	.....	
Cape Desolation; sighted abeam.	10	39°.5	3°.0=1.020084	
	11	36°.0	2°.8=1.018644	
	12	36°.0	3°.2=1.021521	
	1	37°.0	2°.8=1.018527	
	2	42°.0	2°.8=1.018652	
	3	42°.0	3°.0=1.020091	
	4	43°.0	3°.0=1.020107	
		August 5, 1880.		
Latitude 61° 27′.	2	44°.0	3°.0=1.020122	
	3	44°.0	3°.0=1.020122	
	4	36°.0	2°.5=1.016486	Opposite glacier about thirty miles off shore.
	5	37°.0	3°.0=1.020068	
	7	37°.8	2°.8=1.018508	
Lat. 63° N., long. 51°		August 6, 1880.		
	4	38°.0	4°.0=1.027246	
	5	37°.5	4°.0=1.027240	
	6	38°.0	4°.0=1.027246	

[From the Popular Science Monthly, March, 1881.]

The Ocean-Currents of Greenland and Iceland.—Captain N. Hoffmeyer, Director of the Royal

Danish Meteorological Institute at Copenhagen, has published a summary of the facts ascertained in the recent deep-sea explorations of the Danish schooner Fylla, Captain Jacobson, which help to explain why Iceland, lying nearly on the edge of the Arctic Circle, is not frozen like its neighbor Greenland. The first Norwegian Deep-Sea Expedition, under Professor Mohn, brought out the surprising fact that the bank on which the British Islands lie is connected by a submarine ridge, of at most three hundred fathoms below the surface of the water, with the Faroe Islands, and that these islands are similarly connected with the southeast coast of Iceland; further, it was discovered that over this bottom ridge separating the Atlantic water in its great deeps from the water of the Arctic Sea—at least in summer—a relatively warm mass of water was moving toward the northeast which fully prevented the cold bottom water of the Aretic Ocean from flowing into the North Atlantic basin. Since, however, the depths of the Atlantic are occupied with a bed of water only a few degrees above freezing-point, the cooling of which cannot be ascribed to circumstances of place and position, but must be caused by an inflow of polar waters, the facts ascertained by the Norwegian expedition that no such inflow takes place between Iceland and Europe, in the broadest passage between the two seas, has become of the greatest scientific importance. Attention was accordingly directed to the other passages between the two seas—the Denmark Straits between Greenland and Iceland, and Davis's Straits—concerning the features of which not enough was accurately known. The most that had been learned concerning them was the work of a few observers, chiefly Admiral Irminger, who, by comparing the annual reports of voyages between Greenland and Iceland, had found that the Atlantic water along the fifty-ninth parallel, between the Orkney Islands and 30° west, over an extent of about nine hundred nautical miles, had tolerably uniform and relatively high temperature on the surface with a superficial current to the north; that, further, in consequence of this current, the warm surface-water, at least in the summer, reached the south coast of Iceland essentially unchanged in temperature, and was directed thence toward the northwest and north into the Denmark Straits and along the west coast of Iceland; that, on the other hand, a cold stream filled with thick drift-ice flowed from the Polar Sea along the east coast of Greenland through the Denmark Straits to Cape Farewell, and was strong enough to reach over the northwest coast of Iceland and fill its fiords with ice. As an offset to this, the ice does not, even in winter, enter the great bays of the west coast of Iceland, and the fisheries are prosecuted in those waters through the whole year. North of Iceland the stream sets decidedly toward the east, and often brings with it Greenland ice, which blockades the whole coast for a longer or shorter time. Admiral Irminger believes that this stream is a branch of the great East Greenland ice-stream which has rebounded from the northwest coast of Iceland and been deflected to the east. Other investigators have reached conclusions agreeing with these. In order to determine the matters which were in question, the Danish Government, in 1877, provided the Fylla with the necessary apparatus and ordered Captain Jacobson to take soundings and measurements of temperature. He performed his work with much energy, against many difficulties, and discovered that the warm stream which had been mentioned as washing the west coast of Iceland has considerable depth, and that it is strong enough at the North Cape to pass around it in its continued progress along the north coast of the island. The meteorological observations in the Island of Grimsey have also shown that this warm stream affects the island in the same way in the winter and considerably moderates its climate. Nevertheless, in severe winters, the Greenland ice pushes far down and causes the warm current to be covered with its cold meltings; the season is protracted, and Iceland suffers a bad year with hardly any summer.

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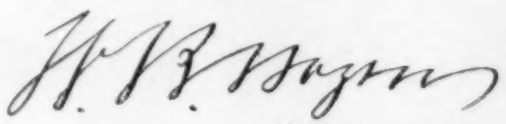

Chief Signal Officer.

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WAR DEPARTMENT WE
SIGNAL SERVICE, U.S. AR
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT O
AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.
No. Velocity.
I. 73 miles per hour.
III. 23 do.
IV. 23 do.
V. 50 do.
VI. 48 do.
VII. 30 do.
VIII. 37 do.
IX. 46 do.
X. 39 do.
TRACKS OF CENTERS OF AREAS OF LOW BARO
PUBLISHED BY ORDER OF THE

No. I.

T WEATHER MAP.
K. U.S. ARMY.
BENEFIT OF COMMERCE AND AGRICULTURE.
Portland
Norfolk
Kittyhawk
Cape Hatteras
Wilmington
Charleston
Savannah
Jacksonville
Punta Rassa
Key West
Havana
W BAROMETER FOR FEBRUARY, 1871.
ER OF THE SECRETARY OF WAR.
CHIEF SIGNAL OFFICER.
NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7 A. M., the 3 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day underwritten, written respectively above and below the line.

WAR DEPARTMENT
SIGNAL SERVICE, U
DIVISION OF TELEGRAMS AND REPORTS FOR THE BEN
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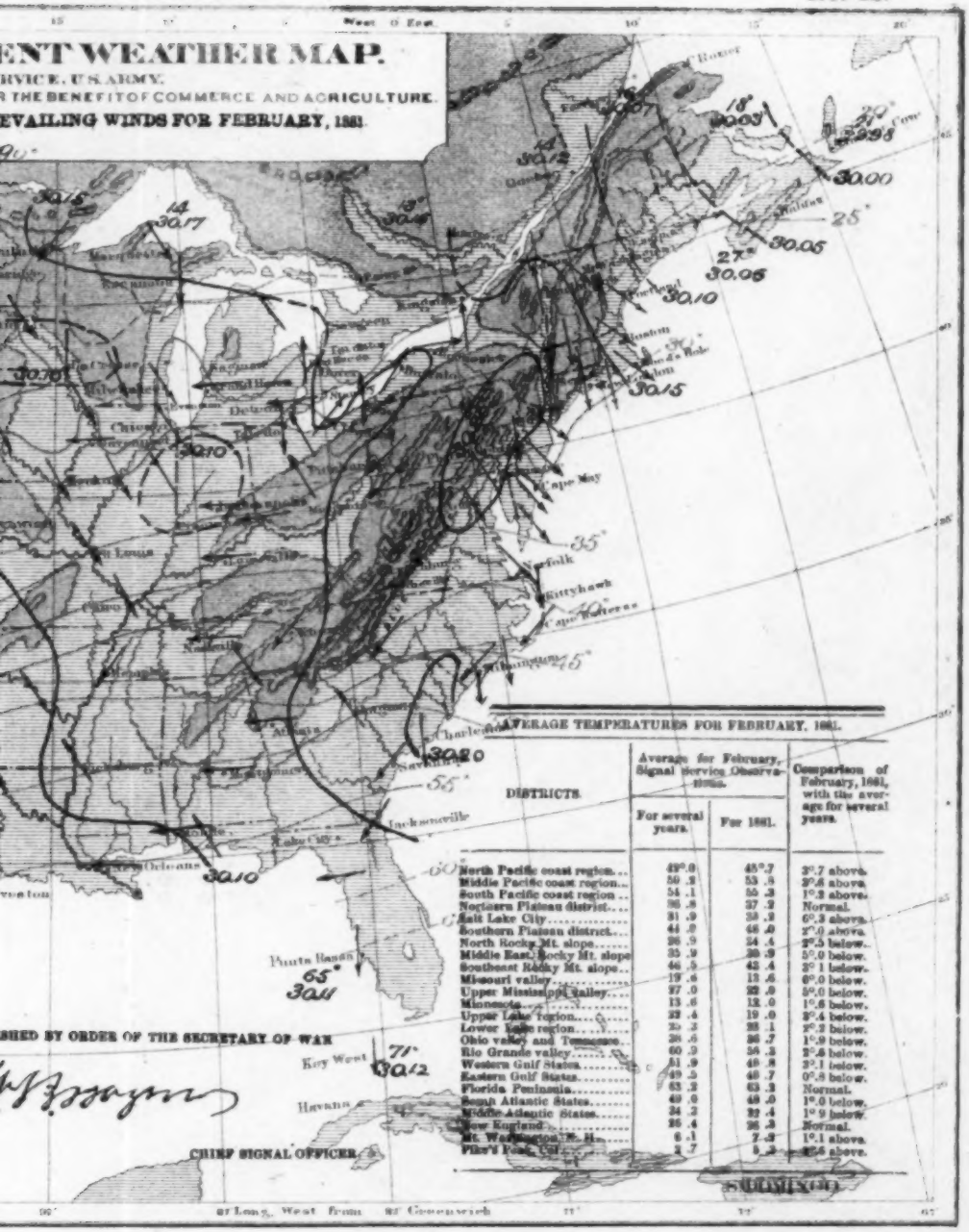
Indianola
Galveston
PUBLISHED BY O
TEMPERATURE OF WATER
FEBRUARY, 1881.
STATIONS.
Temperature at bottom
Max.
Min.
Mean
*Alpena
Antonito
Baltimore
*Buffalo
*Burlington, Vt.
Cedar Keys
Charleston
*Chicago
Chincoteague
*Cleveland
*Detroit
*Duluth
*Erie Breakwater
Fort
*Omaha
Galveston
*Grand Haven
Jacksonville
Key West
*Marquette
*Milwaukee
*Mobile
New London
*New York
Norfolk
Portland, Maine
*Punta Rassa
*Sandusky
*San Francisco
Savannah
Smithville
*Toledo
Wilmington
Wood's Hole
* Observations for only part of month—See text.

ENT WEATHER MAP.

RVICE, U.S. ARMY.

R THE BENEFIT OF COMMERCE AND AGRICULTURE.

EVAILING WINDS FOR FEBRUARY, 1881.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Mobile
New Orleans
Cape May
Norfolk
Kittyhawk
Cape Hatteras
St. Louis
Chicago
Detroit
Toronto
Montreal
Boston
Portland
Halifax
Bermuda
Washington
Baltimore
Philadelphia
New York
Albany
Buffalo
Cleveland
Pittsburg
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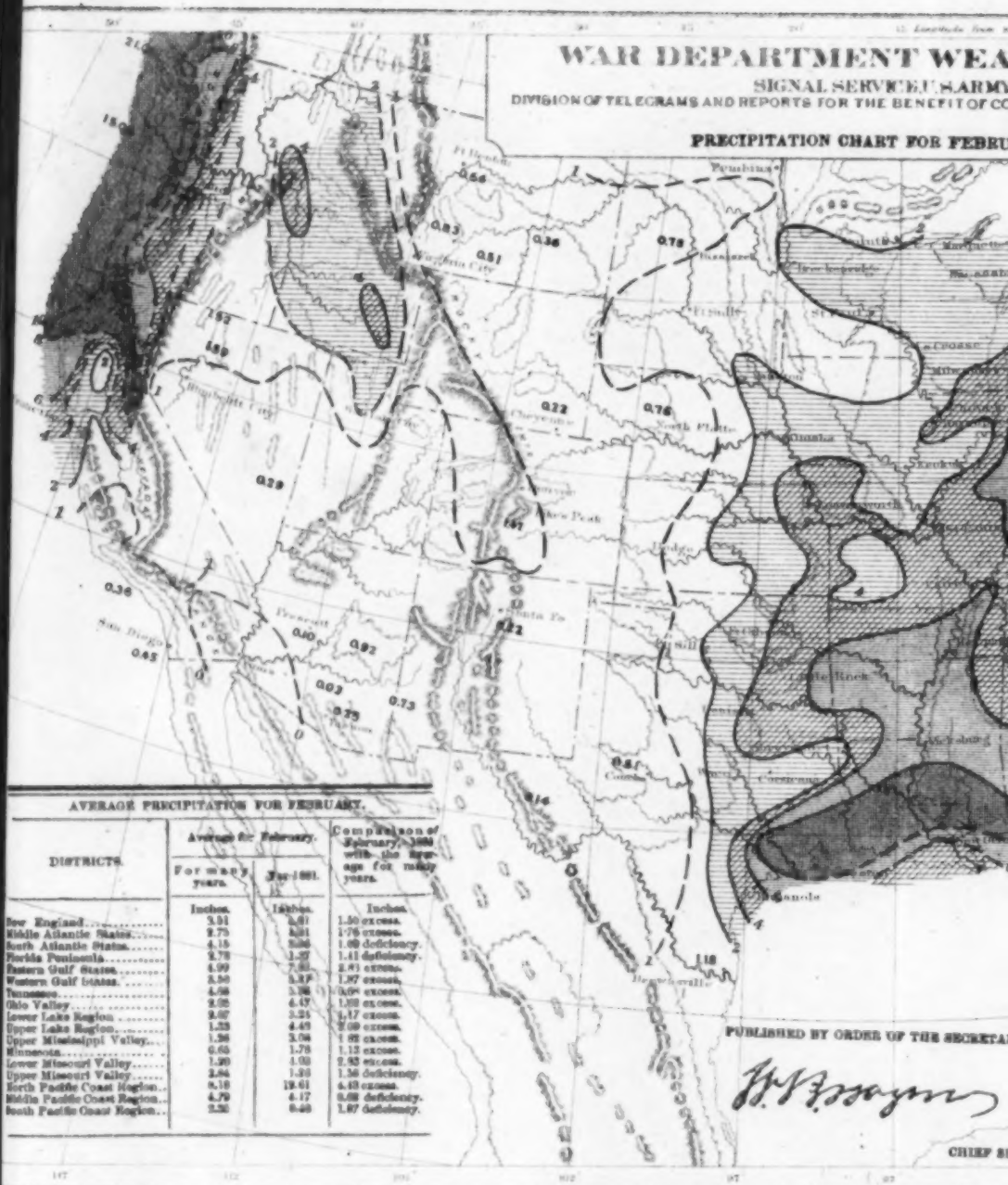
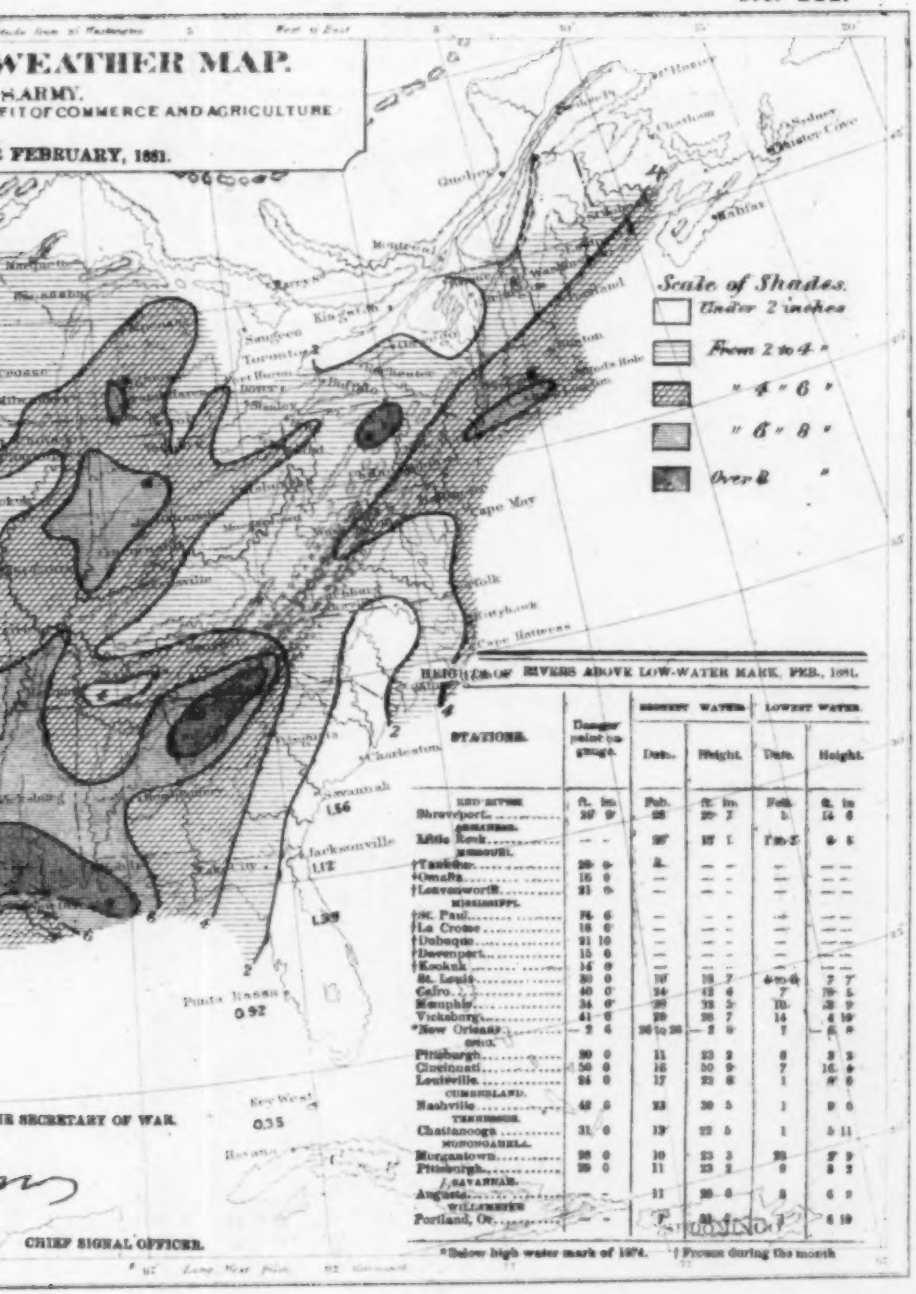
Havana
Punta Rassa


WAR DEPARTMENT WEA
SIGNAL SERVICE U.S.ARMY
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF CO
PRECIPITATION CHART FOR FEBRU
PUBLISHED BY ORDER OF THE SECRETA
CHIEF S

AVERAGE PRECIPITATION FOR FEBRUARY.

DISTRICTS.	Average for February.		Comparison of February, 1881 with the average for many years.
	For many years.	For 1881.	
	Inches.	Inches.	Inches.
New England	3.51	5.01	1.50 excess.
Middle Atlantic States	2.75	4.51	1.76 excess.
South Atlantic States	4.15	3.06	1.09 deficiency.
Florida Peninsula	3.78	2.37	1.41 deficiency.
Eastern Gulf States	4.99	7.31	2.32 excess.
Western Gulf States	3.50	5.37	1.87 excess.
Tennessee	4.58	5.26	0.68 excess.
Ohio Valley	2.05	4.47	1.92 excess.
Lower Lake Region	2.07	3.24	1.17 excess.
Upper Lake Region	1.53	4.43	2.90 excess.
Upper Mississippi Valley	1.36	3.04	1.68 excess.
Minnesota	0.65	1.78	1.13 excess.
Lower Missouri Valley	1.20	4.03	2.83 excess.
Upper Missouri Valley	2.04	1.48	1.56 deficiency.
North Pacific Coast Region	8.18	12.61	4.43 excess.
Middle Pacific Coast Region	4.79	4.17	0.62 deficiency.
South Pacific Coast Region	2.36	0.49	1.87 deficiency.



HEIGHT OF RIVERS ABOVE LOW-WATER MARK, FEB., 1881.

STATIONS.	Danger point on gauge.	HIGHEST WATER.		LOWEST WATER.	
		Date.	Height.	Date.	Height.
RED RIVER	ft. in.	Feb.	ft. in.	Feb.	ft. in.
Shreveport	20 0	28	20 7	1	14 6
ARKANSAS.					
Little Rock	— —	27	17 1	Feb. 2	9 5
MISSOURI.					
†Yankton	20 0	5	— —	—	— —
†Omaha	15 0	—	— —	—	— —
†Leavenworth	21 0	—	— —	—	— —
MISSISSIPPI.					
†St. Paul	14 6	—	— —	—	— —
†La Crosse	15 0	—	— —	—	— —
†Dubuque	21 10	—	— —	—	— —
†Davenport	15 0	—	— —	—	— —
†Keokuk	14 0	—	— —	—	— —
St. Louis	30 0	10	18 7	4 to 6	7 7
Cairo	40 0	24	42 4	7	19 5
Memphis	34 0	29	33 5	15	22 9
Vicksburg	41 0	29	36 7	14	4 10
*New Orleans	2 6	26 to 28	3 9	7	6 9
OHIO.					
Pittsburgh	30 0	11	23 3	8	3 3
Cincinnati	50 0	16	30 9	7	16 6
Louisville	24 0	17	22 6	1	8 0
CUMBERLAND.					
Nashville	40 0	23	30 5	1	9 0
TENNESSEE.					
Chattanooga	31 0	19	22 5	1	5 11
MONONGAHELA.					
Morgantown	28 0	10	23 3	23	2 9
Pittsburgh	29 0	11	23 2	9	3 2
SAVANNAH.					
Augusta	— —	11	20 6	8	6 9
WILLAMETTE					
Portland, Or.	— —	7	21 4	[illegible]	6 10

*Below high water mark of 1874. †Frozen during the month

CHART No. IV.

INDEX TO STORM-TRACKS.

No. I, from Jan. 1st to 5th, 1881.
II, from Jan. 1st to 10th, 1881.
III, from Jan. 7th to 9th, 1881.
IV, from Jan. 9th to 11th, 1881.
V, from Jan. 9th to 14th, 1881.
VI, from Jan. 11th to 14th, 1881.
VII, from Jan. 17th to 21st, 1881.
VIII, from Jan. 17th to 31st, 1881.
IX, from Jan. 22nd to 23rd, 1881.

INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

Broken or dotted lines indicate that the lines so broken are doubtful.

Arrows, when charted, fly with the wind and exhibit wind-direction.

The tracks charted in black have appeared in previous *Reviews*.

The tracks charted in red have been made from data collected since preceding *Review*.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

[redacted] CHIEF SIGNAL OFFICER, U. S. A.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing January, 1877.

PREVAILING WINDS.

Arrows show the direction of, and fly with, the wind. Force is shown as follows:

Symbols.	Force.	Velocity.	
		Miles per hour.	Metres per second.
→	1, 2	0 to 9	0 to 4.0
→	3, 4	9.1 to 22.5	4.1 to 10.1
→	5, 6	22.6 to 40.5	10.1 to 18.1
→	7, 8	40.6 to 67.5	18.1 to 30.2
→	9, 10	67.6 up.	30.2 & over.

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ISOBARS AND ISOTHERMS.

Isobars in *blue*; detached barometer means in English inches.

Isotherms in *red*; detached temperature means in degrees Fahrenheit.

Broken lines, are doubtful.

INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of March, 1877, based on the daily charts of the International Bulletin